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GOVERNMENT OWNED
AND CONTROLLED

COMPARED WITH

PRIVATELY OWNED
AND REGULATED

ELECTRIC
UTILITIES

IN CANADA & THE UNITED STATES

WILLIAM S. MURRAY

MURRAY & FLOOD

Widespread interest in the Hydro-Electric Power Commission of Ontario and a desire for authentic and reliable information regarding its working and accomplishments led the National Electric Light Association to have a report made thereon based on an impartial and exhaustive study.

Accordingly the Association enlisted the services of W. S. Murray, who conducted the Super Power Survey for the United States Government on the Atlantic seaboard between Boston and Washington, and who in addition is conversant with Canadian conditions, having acted for municipal and provincial bodies in a consulting capacity. In this work Mr. Murray was assisted by his partner, Mr. Henry Flood, Jr., formerly Secretary-Engineer of the United States Government's Super Power Survey organization.

The report herewith made public by the National Electric Light Association covers the investigations made by Messrs. Murray and Flood from August 22, 1921, to February 10, 1922, and presents in a comprehensive and comparable way the advantages of electric service rendered by privately owned and publicly regulated utilities in the United States and Canada contrasted with that supplied by the most notable Government-owned utility in the Western Hemisphere, i.e., the Hydro-Electric Power Commission of Ontario.

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Part I

Conclusions and Summary Report

Feb. 10, 1922.

National Electric Light Association,
29 West 39th Street,
New York City.

GENTLEMEN:

This report is divided into two parts: Part I, herewith, which includes "Summary of Conclusions," and Part II, following, which includes "Supporting Discussion of the Facts Ascertained." The report is segregated accordingly, in order that the perusal of Part I may, in condensed form, present the whole subject briefly. However, especial request is made to turn to Part II when the pages and figures of that Section are referred to in the text of Part I.

I met you and your Committee appointed to consider this subject on August 17, 1921, and in the conference that ensued I was advised that it was the desire of the Association to have placed before it all the facts that it was possible to assemble regarding the procedure of the electric utility companies operating in the States and Canada, so that there might be determined therefrom the points for or against governmental or private ownership in the conduct of their affairs. I was advised further that, as the scale of governmental operation found its greatest magnitude in the operation of the electric properties in the Province of Ontario under the leadership of the Hydro-Electric Power Commission, my examination and presentation of the facts in this field were especially desired.

Upon the occasion of this invitation to make such a report, it was not known to you that I had been previously retained by the Hydro-Electric Power Commission on separate occasions, to report first upon the electrification of the London and Port Stanley Railroad (since electrified) and, secondly, in connection with the proposed building of a high-speed electric line between Toronto and the frontier. In advising you of these past associations with the Hydro-Electric Power Commission, I also advised that they had to do with engineering and construction features, and that I had never made an examination of the Hydro-Electric Power Commission's economic structure. The interest and importance of the report appealed to me and I accepted the commission, with the understanding that if my former associations with the Hydro-Electric Power Commission offered any grounds for embarrassment to the National Electric Light Association, you in turn need feel no embarrassment in withdrawing the invitation. Your invitation to make the report was repeated the following day, and as I could associate no reason, irrespective of what facts might be disclosed, why I should not be guided in conclusion by them, the matter was closed and my investigations were begun on August 22, 1921.

I am impelled to present this chronology leading up to accepting service for this report, in order that there may be no misunderstanding as to my position in the matter. I wish also to say that I have held and now hold Sir Adam Beck in the highest esteem. I consider him a man of the most intrepid courage of conviction, and I believe that he has reared a structure in Canada as remarkable for its physical uniqueness as for the administration associated with it. In the same breath, however, I would say that what has been done in Canada could never have been done in the United States;—the corollary of which is that if the conditions in Canada had been what they are in the States today, the Hydro-Electric Power Commission, in my opinion, never would have come into being.

In order that the fullest assistance be given in the ascertainment of facts relating to the electric utilities in the States, you addressed a circular letter to the companies mentioned on page 44, Part II, of this report, and immediately upon accepting your assignment to make this report I wrote Sir Adam Beck as follows:

September 9, 1921.

SIR ADAM BECK, Chairman,
Hydro-Electric Power Commission of Ontario,
Toronto, Ontario.

MY DEAR SIR ADAM:

I was very sorry not to have had the opportunity of seeing you yesterday, but spent a few minutes with Mr. Gaby, explaining the commission I have recently received from the National Electric Light Association, to investigate and report on the electric utility systems as operating in the United States and by the Hydro-Electric Power Commission of Ontario.

As stated to Mr. Gaby, when the Committee of the National Electric Light Association asked me to take up this work, I explained to them that on two occasions I had been retained by the Hydro-Electric Power Commission, mentioning to them the subjects upon which you had requested me to report. Their attitude was, as a result of this explanation, even more pronounced, that my services be engaged upon their matter, particularly in view of the fact that my previous work for the Hydro-Electric Power Commission had been in connection with engineering and construction features, having nothing to do with the economic and political structure of the Commission's plans.

The report I am to render, while having much to do with the two former subjects, is more particularly related to the political and economic structures, as existing in the States and in Ontario, and you will therefore understand that I would take an impossible position to refuse to attempt collecting the complete facts of both situations, and be governed in my conclusions by them.

Accordingly, I am most anxious to see you.

Knowing you, I know there is no frank question that I would ask you but that I would receive as frank an answer. Accordingly, I have prepared a set of questions which are attached to this letter, and I would greatly appreciate having their answers, or a reference to the original data, from which they could be derived.

If it meets with your approval, either I or my partner, Mr. Henry Flood, Jr., will call on Mr. Gaby, promptly, to the end that we may be able to secure the information at the earliest possible date.

Very cordially yours,

(SD) W. S. MURRAY.

Not waiting for a reply to this letter, I proceeded to Toronto and in an interview with Sir Adam, who had then received it, discussed the situation with him and explained that the electric utility officials in the States were very much at sea regarding the facts of the Hydro-Electric Power Commission's policies and operations, and that I wished to set forth the facts in this report so that they would be correctly interpreted beyond peradventure of doubt. Sir Adam advised me that he would place at my disposal the Commission's books and every available data in their hands to assist in this undertaking. That he has made good on this promise may be gleaned from the information presented in Part II. To Sir Adam, Mr. F. A. Gaby, the Commission's Chief Engineer, and Mr. W. G. Pierdon, the Chief Accountant of the Commission, a very sincere debt of thanks is due. There has been a disposition on the part of these gentlemen to respond to every request for full information, and many times on subjects that could be interpreted as almost personal.

The applications of electric power in Canada are exactly the same as those in the States, and in any locality the goodness of power is based upon whether it is sufficient, reliable and cheap. In my opinion, Canada's future need have no fear with respect to sufficiency of power. Reliability and cheapness are intimately associated with the economic structure which lies behind its production. Potentially equipped with enormous water power resources, does the Hydro-Electric Power Commission furnish a structure possessing characteristics to insure reliable and cheap power?

In the findings of this report, the fact should not be permitted to escape for one moment that out of all the power generated for which the Hydro-Electric Power Commission stands sponsor in Ontario, 87% is produced at Niagara, which, through the constancy of flow of the river bearing that name, in combination with a sheer drop at the escarpment at Niagara Falls of 220 feet and a total drop of 326 feet between Lake Erie and Lake Ontario within a distance of 27 miles, offers a site unexampled in the world where hydro-electric power can and should be produced cheaply. Therefore, in making cost comparisons with other power systems in the States and Canada, it must be remembered that not only

are most of the other hydro-electric systems handicapped through their sites lacking the physical conditions which prevail at Niagara, but, due to incomparably lesser dainage areas than that offered by the Great Lakes basins, their stream flows have great seasonal variations and, in general, are supplemented by steam-produced power.

The international treaty between the United States and Great Britain provides certain permissible diversion of stream flow at Niagara Falls, and, according to the report of General Taylor to the War Department of the U. S., after deductions are made for the water applicable to the Canadian Niagara Power Company, the Ontario Power Company and the Electrical Development Company on the Canadian side, and the Niagara Falls Power Company on the American side, there is left 575 cubic feet per second for the Canadian side, and 230 cubic feet per second for the American side.

The density of power requirement per capita within a zone upon the Canadian side has not reached the density of a zone comparable to it on the American side. The result of this is a ratio of 15% steam requirement on the Canadian side, while for the American side the power in service is made up of 67% hydro-electric and 33% steam. These two zones, lying closely adjacent and being fed in the main by the same source of power, offer opportunity of constructive criticism in respect to the economic structures from which the customers of each receive their power.

Lying next to the Province of Ontario, the Province of Quebec with its electric power systems offers opportunity of comparison with the two aforementioned. Here it is important to point to the Commissions in these provinces and in the States to whom the people must look for protection in the dispensation of a fair rate of pay for power service. In the States, bodies known as "public service commissions," and appointed by the respective governors of the States, are delegated regulatory powers, limited, first, to the authority of passing upon the issuance of securities, representing physical investment in the properties, and, second, to authority in respect to the rates that shall be charged for power. It is proper to say here that, in order that the fairest comparison could be drawn between the authority and activities of the public service commissions in the States and the authority and activities of the Hydro-Electric Power Commission of Ontario, the California Railroad Commission is referred to, not because its powers are any broader than those of other commissions in the States, but because it is a model of their best type. In the Province of Quebec a public service commission of more potential than active aspect than the Commission in California represents the electric interests of the people. I would especially refer here to page 147, Part II, of this report, which in parallel columns shows the powers and duties of the several Commissions named.

Prior to reading the summary of my conclusions, it will be well to review as briefly as possible the

principal captions under which the supporting discussion and facts behind them are assembled in Part II. They are as follows:

Section A—Title: "Correspondence between Mr. W. S. Murray and the Electric Utility Companies, the Hydro-Electric Power Commission of Ontario and officials of the Province of Ontario."

Section B—Title: "Organization and Growth of the Hydro-Electric Power Commission of Ontario."

Section C—Title: "Laws in respect to the Authority of the Hydro-Electric Power Commission of Ontario and the Relations of the Province and Municipalities to the Commission."

Section D—Title: "The Cost of Power to the People of Ontario, Served by the Hydro-Electric Power Commission."

Section E—Title: "Indebtedness, Assessments and Taxes in the Provinces of Ontario and Quebec."

Section F—Title: "Queenston-Chippawa Development for the Niagara System of the Hydro-Electric Power Commission of Ontario."

Section G—Title: "The Nipigon Development for the Thunder Bay System of the Hydro-Electric Power Commission of Ontario."

Section H—Title: "Rates for Power to the People of Ontario using Hydro-Electric Power Service, and Comparisons of the Rate-making Methods Employed by the Hydro-Electric Power Commission with those of the California Railroad Commission."

Section I—Title: "Comparison in Respect to the Cost for Power to the People of the Provinces of Ontario and Quebec and for Certain Sections of the United States."

The term "Government Ownership" needs explanation. In Ontario this term, used throughout the report, is associated with both the Central and Local Government.

In the States "Municipal Ownership" has reference to a city only. Further, in Ontario the Government-owned electric utilities of the various cities are in association with each other as a Municipal League, and the indebtedness they incur is guaranteed by the Province.

Wherever the phrases "owned" or "owned and controlled by the Commission" are used, these are intended to mean "owned" or "owned and controlled by the Commission for the municipalities."

Part II of this report entitled "Supporting Discussion of Facts Ascertained" has naturally been written prior to the summary report, the summary report aiming to cover the whole subject in as few pages as possible. The line of demarcation between facts of prime and secondary importance is in some cases a difficult one to draw, and, while it is hoped that the summary report has been made inclusive of all prime and necessary considerations to the subject, it is especially recommended that reference be made to Part II.

Summary of Conclusions

After a careful analysis of the governmentally-owned, controlled and operated electric utility structure as represented in the Hydro-Electric Power Commission of Ontario, I am of the opinion, firstly, that the principles of its application can find no place in the United States; secondly, that to attempt the substitution of its principles of control and operation within the States would be to strike a blow at economic structures, the present existence of which are not only far better equipped to protect the public interests in their conjunctive relation with the public service commissions of the States regulating their rates, but it would also be to strike an equal blow at the shareholders of the electric utilities which are now serving the American public; and, thirdly, that the Hydro-Electric Power Commission owes its being only to the fact that a public service commission on the order of those operating in the States was not in existence in the Province of Ontario at the time of its creation.

I support the above statement in the following conclusions:

- (1) Power as applied in Ontario from the governmentally-owned and controlled system in associate relationship with the Hydro-Electric Power Commission to be superior in kind to that supplied by the privately-owned electric utilities of the United States must be more adequate, more reliable and cheaper. The facts show, however, that the electric utilities of the States hold more power in reserve and sell more energy per capita served, that by that token they can claim a greater reliability of supply and that the supply is cheaper to the consumer.
- (2) At the end of the fiscal year 1920, out of the total power plant capacity operated by the Hydro-Electric Power Commission only 23% of it was constructed by the Hydro-Electric Power Commission; the remainder represents plant capacity constructed at the initiative and risk of private investors, and in acquiring ownership of it, such intangibles as franchise rights, good-will and other intangibles were included in the purchase. This intangible cost, therefore, is represented in power "at cost." If a governmental plan of like characteristics to that of the Hydro-Electric Power Commission is to be inaugurated in the United States, it must include the purchase of or the contracting of power from existing utilities and the same problem of including intangibles will be presented here.
- (3) The building of new power plant facilities under the auspices of governmental ownership, as shown in the cases of Nipigon and Chippewa, both in respect to policy and cost, is not to the economic interest of the people.
- (4) The advocates of government or municipal ownership of electric utilities claim reduction in the cost of power in virtue of

- (a) Elimination of taxes
- (b) Elimination of dividends.
- (c) Elimination of high-salaried executives
- (d) More economical wage and higher efficiency in labor scale.

With regard to (a)—taxes are not eliminated. Just as much money in taxes is paid. The difference is in their distribution. In the case of private ownership, only the users of service pay the tax bill, while in the case of government-owned utilities all the people pay the bill.

With regard to (b), (c) and (d), notwithstanding dividends, high-salaried executives and the wage and labor claim, the answer is, when the total operations are summed up, the people receive the power at less cost through private ownership under regulation.

- (5) The investment of capital in electric utilities under private interest control is far better protected from extravagance than when that capital is governmentally-owned, for the reason that plans and estimates for such capital expenditures not only must gain the approval of a trained engineering and managerial staff and an experienced board of directors of the companies, but it also must have the critical review of the banker and the private financial investor. In the case of government-owned utilities, the directing heads are seldom specifically trained in the business under their jurisdiction, and value of securities is not based upon the value of the property or the efficiency of management, but upon the taxing power of the government.
- Arms, legs and body are useless without the head. A high-salaried executive usually saves many times (his salary included) the losses incurred by the cheaper and less efficient executive. Accomplishment by individuals in control of private enterprise is under keener observation than is the case when those in charge are governmental or municipal officers.
- (6) Governmental ownership eliminates all incentive for gain and throttles initiative. This is evidenced by the far greater growth of privately-owned utilities.
 - (7) The Hydro-Electric Power Commission is the judge of its own acts. A commission cannot fairly be the judge of its own (and others') rights in contentions.
 - (8) Honesty of purpose does not necessarily reduce the power bill. The structure under which it is administered counts just as much—so far as the price is concerned.
 - (9) The American companies in the Niagara district are supplemented by steam power far more than those on the Canadian side, and yet on the American side power is being furnished at less cost to the people.
 - (10) The Commissions of the States fully realize that protection to the people lies in protection

to the electric utilities from which they are receiving power. The authority delegated to them to regulate rates, and the constitutionality of the law standing behind any action on their part or on the part of the electric utilities, provides a structure constructively balanced to do justice to all parties.

SUMMARY REPORT

Questions Laid Before Sir Adam Beck

As noted in my letter of September 9th to Sir Adam Beck previously referred to, there was attached to that letter a set of questions bearing on the operations of the Hydro-Electric Power Commission. They were supplemented later by additional questions, in all sixty in number. Section A, Part II, of the report reproduces these questions, and under date of October 21st Mr. F. A. Gaby, Chief Engineer of the Commission, made reply to all of them and later, on December 2d, supplemented his reply with certain revised answers. In the same Section of the report, following each question, Mr. Gaby's answers may be read.

Also on page 23 of Part II is reproduced my letter to Mr. Gaby, supplementing the one I wrote Sir Adam Beck, and which is previously referred to. It may be noted from that letter that I had omitted to ask the following question:

"If, as in the United States, there had existed in Ontario a public service commission for the purpose of controlling the rates and issuance of public electric securities, thus guarding the interests of both the people and capital investment, would it then have been necessary to create the Hydro-Electric Power Commission?"

This question had been propounded to Mr. Gaby upon the occasion of meeting him with my partner, Mr. Henry Flood, Jr., at the King Edward Hotel. His answer to it at that time left no doubt in my mind or that of Mr. Flood that, under the conditions named, the Hydro-Electric Power Commission would not have been required, and Mr. Gaby's answer to Question 1, Section A, Part II:

Q. "What was the reason for the inauguration of the league of municipalities and the Hydro-Electric Power Commission?"

A. "The companies did not endeavor to meet the wishes of the people or make any effort to co-operate, explain or take the people into their confidence"—etc., etc.

would seem to confirm the original answer. It would be highly improper to omit to say, however, that subsequent to my conversation with Mr. Gaby, in conversation with Sir Adam Beck, I asked him the same question and his reply was that the Commission was justified under any conditions. I am not surprised at having received this answer, because I am confident that Sir Adam Beck believes absolutely that the Hydro-Electric Power Commission is producing power which is the most reliable and cheapest in the world. At the time I asked this

question of him, my investigation had but begun, my mind was entirely open and I had no grounds to contest such a belief; further, there are no physical reasons why it should not be. The officers of the Commission throughout my investigation, pressed upon them in the midst of an excessively busy time getting the Queenston-Chippawa Plant in operation, have made an effort in every direction to give me facts and information regarding investment and operation upon which to premise the conclusions I am now able to present. Mr. Gaby and Mr. Pierdon, the Commission's Chief Accountant, have given freely of their time, and it was always apparent that they wanted the facts made known in the entertainment of the belief that when they were assembled it would be shown that power as produced by the Hydro-Electric Power Commission was cheaper compared to any elsewhere. In turn, I made it apparent that I was going to "chop and let the chips fall where they may," and they met me as one in this spirit of fair play. Facts are impersonal things. Sometimes they hurt, but no school produces teachers such as they. This report cannot and does not intend to dim the glory of Hydro's achievements. [Hydro replaced certain unregulated private electric utilities whose operations were far inferior to it.] The principal problem was to determine whether there was anything in the Ontario Plan to commend itself as applicable in the States. The facts as assembled, and their concurrent conclusion, answer "No."

The sixty questions and their answers previously referred to have brought out the information desired, and it is especially requested that a careful perusal be made of these questions and their answers appearing in Section A, Part II, of the report.

Interviews with Premier Drury and Hon. Peter Smith

On December 13, 1921, Premier Drury and the Hon. Peter Smith, Provincial Treasurer, favored Mr. Flood and myself with interviews, and following the sixty questions previously referred to are seven questions presented to and answered by Mr. Smith and nine questions presented to and answered by Premier Drury.

In considering the matter of power "at cost," it is important to note the triangular corroboration of Mr. Gaby, Hon. Peter Smith and Mr. Clarkson (the Hydro-Electric Power Commission's Public Accountant), in respect to the purchase of the Ontario Power Company. In answer to Question 22 to Sir Adam Beck, the answer states that the bonded indebtedness (\$14,000,000) of this company purchased by the Hydro-Electric Power Commission, was assumed by the Commission, and \$8,000,000 in bonds of the Commission was given in exchange for the outstanding stock of that company. Mr. Clarkson places no physical tangible value in connection with the stock issued, while the Hon. Peter Smith, referring to the franchise, water rights, good-will and other intangible assets which the stock stands for, advises that he "prefers not to suggest an answer to the question."

Money has been paid for such intangibles and therefore power at cost to the people must include them. Here, therefore, seems to be the place to say that where the Hydro-Electric Power Commission offers such purchased power, as power "at cost," this does not mean power produced by a value of the works alone, but includes a money loss in interest on the sum paid for the intangibles.

Still referring to Section A, Part II, as an evidence of the power and authority of the Commission (more fully discussed under Section C, Part II), I would refer to page 38, whereon is given the answer of the Provincial Treasurer to Question 2 asked of him. The question was:

"Does the guaranteeing of bonds, either of the Hydro-Electric Power Commission or of the bonds of private companies assumed by them without the action of the legislature, remove from the people the right to vote money?"

The answer—

"The legislature has given the Lieutenant-Governor in Council unlimited authority to guarantee bonds in connection with the purchase of power companies, and while it is not strictly correct to say that it is an interference with the exclusive right of the legislature to vote money, the Hydro-Electric Act does give the Lieutenant-Governor in Council unlimited powers to pledge the credit of the province."

I gained from my conference with Premier Drury an important point, namely: that the province, since it was being called upon by the Hydro-Electric Power Commission to guarantee the bonds it was placing, believes the Commission should give an accounting far more satisfactory than that which had obtained in the past of the money expended in its works. Since this report was started, the Premier had given public evidence of his support to the Hydro-Electric Power Commission movement as an instrumentality in the interests of the people, but the interview Mr. Flood and I had with him, together with what he has said since in many addresses on that subject, leave no room for doubt that he believes that the government should be provided with the power to check, prior to its approval of the large expenditures to be made by the Commission—this in order that the assets of the province might be protected.

Origin of the Hydro Movement

In a subject of such breadth, importance and inter-relation, it is difficult to escape some duplication of text. Section F touches in part upon the growth and development of the hydro-electric plan in Ontario, but Section B deals in detail with this matter.

The plan of governmentally-owned and operated electric utilities grew out of the belief by seven municipalities lying within transmission distance of Niagara Falls, that power therefrom could be generated and transmitted to them at a cost far less than

that being paid for the supply received from private companies, and then later, the scheme spread throughout the Province of Ontario, and today, instead of seven of the municipalities receiving Hydro-Electric power, the number has increased to over two hundred.

The hydro movement took its first concrete step by the appointment of a Committee of the Toronto Board of Trade on April 25, 1900, to authorize and specifically investigate the power needs of Toronto, and the hopes of this Committee were expressed in the following words taken from its report:

"Our hope for cheaper power is to bring the current from one of the great Niagara generating plants. The Toronto Electric Light Company have signified their intention of bringing power from Niagara Falls, and the question arises whether or not Toronto as a city should control this proposed Niagara power connection." . . .

Following this there was created the Ontario Power Commission, which reported favorably upon the construction in the interests of the seven municipalities previously referred to, of a generating plant at Niagara, with contemplated capacity of 30,000, 60,000 or 100,000 kilowatts; \$4.95 per horsepower per annum was figured as the cost of power that could be delivered at the buses of the plant if constructed to the capacity of 100,000 horsepower. Following upon the report of the Ontario Power Commission in 1906, the Hydro-Electric Power Commission was created; this occurring in 1906. The first laws laying down the authority and duties of the Hydro-Electric Power Commission under the Power Commission Act were placed on the statute books of the province in 1906. As years have passed additional powers have been granted, and those of principal importance are presented in Section C of Part II.

The Hydro-Electric Power Commission, not acting under the Ontario Power Commission's recommendations to build, elected to contract with the Ontario Power Company of Niagara Falls for the power to be supplied to the municipalities, for which it was agreed to pay \$9.40 per horsepower per year for the first 25,000 horsepower, and \$9.00 per horsepower per year for all power in excess of that amount, these rates applying at Niagara Falls on the 12,000-volt bus of that company. The contract was made August 12, 1907.

In Figure 1, page 43, comparison is made between the wholesale cost estimated by the Ontario Power Commission for power to be received from a 30,000 horsepower development, and the actual wholesale rate paid in 1913, when the sales of the Niagara System amounted to 37,000 horsepower, while Figure 2, page 100, shows the comparison between the estimated wholesale costs and those actually attained when the Niagara System was purchasing greater than 100,000 horsepower.

The first ten-year term of the contract between the Hydro-Electric Power Commission and the Ontario Power Company for the purchase and sale

of power would have terminated in August, 1917. By 1916, the Commission's load on the Niagara System had grown to such an extent that it was necessary to purchase additional power from the Canadian Niagara Power Company, which was paid for at the rate of \$12.00 per horsepower per year, with 12,000-volt delivery, and for the year 1920 this company was selling to the Hydro-Electric Power Commission an average of about 68,000 horsepower.

The Growth of Hydro Service

By reference to Figures 3 and 4, pages 47 and 49, impressions regarding the growth of hydro power may be gained. In the districts served by Hydro 10% of the population served were Hydro consumers for the year of 1911; 17% for 1920; and today its power is available to 55% of the total population of the Province of Ontario. In this statement, however, the fact must not be lost sight of that, while power is now available through the operations of the Hydro-Electric Power Commission to 55% of the total population of the Province of Ontario, it has been made so through the acquisition by the Commission of a very large percentage of companies previously owned and controlled by private interests.

Water Power Development in Ontario and Quebec

Figure 5, page 51, shows the growth of the water power developments of the Province of Ontario as compared to those of the Province of Quebec, between the years 1911 and 1920, inclusive, upon a per capita basis. In 1911, the Province of Ontario had developed 75% more water power than that of the Province of Quebec, a large part of the capacity in the Ontario Development being at Niagara Falls. In 1915 Ontario was leading the Province of Quebec in water power development on a per capita basis by 12%, and in 1920 by 24%.

During the five-year period from 1911 to 1915, power development in the Province of Ontario was proceeding at a rate of increase of 6% per annum, while that of the Province of Quebec was 15.5%. The following five years, from 1916 to 1920, inclusive, a part of which covered the period of the World War, Ontario's increase of water power development was at the rate of 3%; Quebec's at 1%. For the entire ten-year period, the rate of water power development per capita in the Province of Ontario has been about 5% per annum, while that of the Province of Quebec, about 9%. None of these results include the additional capacity that will be brought into service by the Queenston-Chippawa Development, or the Nipigon Development in Ontario, or the 60,000 horsepower under construction in the Province of Quebec by the Shawinigan Falls Water Power Company and the Cedars Rapids Development.

Figure 5, page 51, brings out the retrenchment policy on the part of the Quebec privately-owned companies in not building during the high price period. Per contra, the Queenston-Chippawa Development was prosecuted during that period, this

little hope, I would conjecture, that power could be received from it to help out the war load.

Power Plant Capacity Constructed by Hydro

The extensiveness of the Hydro-Electric Power Commission's operations might easily carry the impression that power originates from plants of their own construction. Up until December 28th of this year, only 40,000 horsepower of capacity on the Niagara System of their own construction was furnishing power, the supply coming entirely from the Ontario Power and the Canadian-Niagara Companies. It is of interest to note that in 1918, with the total then developed water power capacity of the Province of Ontario standing at 750,000 horsepower, the Commission had constructed less than 1% of this total. Even with the full five units of the Queenston-Chippawa Development going into commission, the percentage of plant capacity constructed by the Commission to the total capacity serving the Niagara System will then be only 51%, assuming all contracts with the Canadian-Niagara Power Company terminated. I make a particular point of mentioning this because of the fact that in the purchases of the several properties now supplying power, and if their assets, as in the case of the Ontario Power Company, do not represent full physical valuation, it becomes incumbent upon the Hydro-Electric Power Commission to effect these additional costs through a more efficient operation of the total system. But in this regard I am forced to the conclusion, through a reference to the facts pertaining to ratio of operating expense to total revenue as brought out in Section I, Part II, of the report, that the losses incurred in such purchases cannot be recovered, which again checks the general summation as presented in Section I, showing the greater costs to the consumers per kilowatt-hour generated by the Hydro-Electric Power Commission, than the costs indicated for Quebec and California, and the Niagara District in the United States.

The "Clean-up Deal"

There has been much interest expressed in what has since been known as the "clean-up deal." This consisted of a purchase by the Hydro-Electric Power Commission of the Electrical Development Company, its attendant transmission lines to Toronto and the local light and power company in Toronto. The salient facts in this situation are brought out in Section B, Part II.

The Hydro-Electric Power Commission

There are three members of the Commission. They are appointed by, and their tenure of office is held at the pleasure of, the Lieutenant-General in Council. The laws in respect to the authority of the Hydro-Electric Power Commission have been and are enacted by the Provincial Legislature of Ontario and were first placed upon the statute books of the province in 1906.

Since the creation of the Hydro-Electric Power Commission, Sir Adam Beck has been its Chairman, gest a...

—one of, if not the most powerful personalities in Canada.

Investments Controlled by Hydro

The Hydro-Electric Power Commission is the trustee for the generating and transmission properties of the utilities of Ontario and to a very large extent it controls the electrical investments and operations of the municipalities themselves.

The government electric utilities in Ontario have grown from a league of seven municipalities formed in 1903 until now the vested interests of the people in this class of property are represented by investments totaling nearly \$200,000,000, the bonded indebtedness of which is guaranteed by the Province of Ontario and which in 1920 represented 70% of that of the province itself.

The Powers of the Hydro-Electric Power Commission

In Section C of the report is presented the principal laws applying to the Hydro-Electric Power Commission's operations that have been passed by the legislature since 1907 to the present date. These have been enacted in legislative session under what is known as the "Power Commission Acts."

The Acts as they have been passed have gradually clothed the Hydro-Electric Power Commission with powers remarkably unusual as compared with any other commissions in the world, and while the Railroad Commission of California, regulatory only in connection with the control of the electric utilities, does not approach in authority that of the Hydro-Electric Power Commission, yet, as a public service commission, its powers are characteristic of the best commissions of the States and accordingly it has been deemed expedient, after an analysis of the powers granted to these two Commissions, to specify in parallel columns under identical captions, the authority and limitations of each. A third column has also been added pertaining to the authority and duties of the public Service Commission of the Province of Quebec.

I would especially request in order that the fullest relationship of authority between these commissions be thoroughly understood that a careful perusal be made of the parallel columns in Section C, Part II, of this report.

In a discussion with Mr. G. T. Clarkson on November 16th, 1921, in respect to the authority of the Hydro-Electric Power Commission, he gave it a line of descent with prerogatives on the order of "the King can do no wrong." One of the Power Acts reads:

"The Commission shall have the exclusive jurisdiction as to all matters in respect of that authority as by Act conferred upon it and nothing done by the Commission within its jurisdiction shall be open to question or review in any action or proceeding or by any Court"—

and would confirm this point of view. The Hydro-Electric Power Commission, as can be seen from

this, stands alone and aloof above other jurisdictions and is apparently the sole judge of its own acts.

Contrast between Hydro and Commissions in United States

In this aspect I see it fundamentally in contrast to the public service commissions in the United States, whose acts stand always subject to the constitutionality of the law and to court review as to the justice of their acts. I have never subscribed to governmental ownership of electric utilities in the United States, and since my analysis of the situation in Canada, I cannot do so there. However, the people of Ontario so voted, and the question now is—does not this action set up two kingdoms of power; the Province itself on the one part and the Hydro-Electric Power Commission on the other; and indeed, this is precisely what has happened, as the Provincial Government is now demanding a stewardship accounting of the Commission's proceedings in the matter of the expenditures it has made on behalf of the municipalities of that province.

No greater attest of the faith of the people of Ontario in the Hydro-Electric Power Commission could have been made than that which is represented in the authority conferred upon it by the laws now on the statute books in the province, and in no man can there exist a greater honesty of mind and purpose than in Sir Adam Beck, who has been the indefatigable leader and Chairman of this Commission. However, neither the vote of the people nor the honesty of Sir Adam Beck necessarily makes the policy a correct one. I cannot find justice in a jurisdiction which permits the Commission to recover damages by process of law when persons contracting with it are not allowed the same relief.

Advantages Taken of Power Commission Act

As I read the many enactments passed under the Power Commission Acts, I find an authority granted to a few which might be made the instrumentality of great injustice to many should the minds in control incline in that direction. There are a very considerable number of persons and corporate interests in Ontario who possess the feeling that the Commission has dealt with them unfairly, and, notwithstanding the inherent fairness of mind possessed by Sir Adam Beck, it is plain that corporate advantage has been taken under the powers granted the Commission. I think an example in point is the suit that was brought and won by the Toronto Power Company against the Ontario Power Company owned by the Commission. Under the terms of the "Water-Powers Regulation Act" of 1916, it was allowed that any power or water in excess of the amount permitted to be generated or used, as determined by the inspectors of the Province should be sold to the Hydro-Electric Power Commission at a price named by the Province. It was only by virtue of that fact that the Ontario Power Company had retained its corporate existence, that a suit to recover loss from an inadequate price named was won by the Toronto Power Company. Had the

Ontario Power Company lost its corporate identity, in accordance with the Power Commission Act, no suit could have been brought, since the Commission cannot be sued without fiat from the Attorney-General, and to date no fiat has ever been granted.

Again, the situation regarding rates for power, both in respect to the Hydro-Electric Power Commission and to the privately-owned utilities in Ontario, is a remarkable one. In the case of the privately-owned utilities, they cannot resort to the rulings of a Commission regarding their rates, as no regulatory body which has jurisdiction in such matters exists in that Province, and with regard to the Hydro-Electric Power Commission's rates, how can a body with both executive and regulatory powers regulate rates for its own properties with justice to the complaints made against its own actions?

Again, one of the basic laws established by the Power Commission Acts was the establishment of a sinking fund which would return the governmentally-owned electric utilities debt free to the people at the expiration of thirty years. It is impossible to escape the conclusion that this fundamental condition so laid down has been evaded. An example of it is found in the retention of the Ontario Power Company as a private company, and by so doing, the Commission escapes the payment of the sinking fund on the \$8,000,000 of its own bonds, and the full sinking fund payment required by the Act to be paid on the \$14,000,000 underlying bonds of that Company, assumed by the Commission.

A remarkable situation created by one of the laws passed under the Power Commission Acts requires that a municipality assume the debt to provide the facilities necessary to the supply of power to an individual or corporation in that municipality, if request for power is made, and the only recourse to recovery if the bills for power are not paid is the levy of tax against the party contracting.

The Function of the Hydro-Electric Power Commission

The Hydro-Electric Power Commission, by the Power Commission Act, is a Public Service Commission, an Engineering Company, an Electric Utility Company, a Holding Company, a Construction Company; a Banker; a Manufacturer; a Supply Dealer; and an Underwriter's Inspection Bureau, and, with the powers it holds, initiative in the private pursuits of these arts—except banking possibly—is throttled. In consequence, competition in these trades is discouraged, and it must follow that lower costs can be obtained only under circumstances where such conditions do not exist.

The Province's Commitments to the Power Companies at Niagara Falls

The Queen Victoria-Niagara Falls Park, in granting licenses to the Ontario Power Company, the Canadian-Niagara Company and the Electrical Development Company, obligated the government not to go into competition with these companies in

developing power from Niagara Falls. In 1916, the legislature passed an Act, the wording of which is:

"The exercise of the powers which may be conferred by or under the authority of this Act or of any of them shall not be deemed to be making use of the waters of the Niagara River to generate electrical or pneumatic power within the meaning of any stipulation or condition in any agreement entered into by the commissioners for the Queen Victoria and Niagara Falls Park"—

this with reference to the construction by the Commission of an hydro-electric plant at Niagara. This particular clause caused so much resentment that the Act was amended in 1917, making the municipalities, rather than the province, the owners of the proposed Niagara Power Development and inasmuch as the municipalities were not directly the government, it was thereby considered that faith had not been broken between the Victoria Park Commissioners and the original power companies located at Niagara Falls. Such a fine distinction does not, it seems to me, remove from the government the responsibility of having broken faith with its original contracts, through the Park Commission, with the power companies.

The Faith of the People in the Hydro-Electric Power Commission

It is apparent as one reads the many laws enacted that the faith of the people is in an all-wise, unerring commission which "can do no wrong," and legislation has been constantly passed so that the Commission is entirely free from any character of inhibition; barriers, legal or otherwise, are leveled to give free swing to the conscience and action on the part of the Commission.

A power of procedure has thus been granted to the Commission, unlimited. The privilege of personal and official association with its splendid officer, Sir Adam Beck, has never failed to register with me the integrity of his mind, his duty and the purpose of the Commission, namely, service to the people. In this regard, I have therefore only to make the highest commendation, and my personal regret is one of a very considerable magnitude when adhering to conclusions at which I have arrived, based upon the facts as found. The facts compel me to show by this report the economic results which fairly indicate that the production of power under the auspices of the Hydro-Electric Power Commission plan does not bring to the people a result as advantageous as that which the people of the Province of Quebec and those in the United States receive.

Taxes in Ontario and Quebec Compared

All property held by the government electric utilities in Ontario is tax free, with the exception of that applicable to land. In so far as its effect on the cost of power, taxation is insignificant in Ontario.

The Provinces of Ontario and Quebec offer interesting comparisons having regard to their compul-

sory, balanced and ordinary taxes, the meanings of which are explained in Section E, Part II, of the report. In that Section of the report are presented Tables 16 and 17, pages 115 and 116, and Figures 11 and 12, pages 111 and 113, to respectively detail and show graphically the tax situations for the two provinces. The total taxes for all properties in Ontario upon a per capita basis as compared to Quebec are much higher, yet, while the people of Ontario are spending money far more rapidly than in Quebec, they are also setting aside greater sinking funds for the retirement of their debts than are the people of Quebec.

The difference in population between Quebec and Ontario, for which municipal statistics are shown, is slight; Ontario having 1,322,262 people, while Quebec, with 15% less, has 1,135,845. Table 17, page 116, shows the ordinary expenses in Ontario to be \$49.30 per capita, as against Quebec's \$27.10, but in that same table, it is to be noted that Ontario's sinking fund in mills per dollar of assessed valuation is 5.62 as against Quebec's 2.89.

In a letter of August 15th, 1921, addressed to the Court of Revisions of Toronto, by the Sheet Metals Project Company of Toronto, and to which was appended a certificate by Messrs. Price, Waterhouse & Company, as to the correctness of the figures named, it was shown that apart from the duplicate additional tax to be estimated by the city on the business of 1920, that Toronto was supporting a taxation rate of 52.8 mills against Montreal's 28.3 mills. Therein also is quoted a letter from Commissioner Ross of the City of Toronto, dated September 9th, 1921, calling attention to the very great increase in debt during the past year.

In Section E of Part II, Figures 11 and 12, pages 111 and 113, bring out the higher rate of taxation for the industrial cities of Ontario as against those of Quebec. It may be argued that public accommodations in the Province of Ontario are greater than those in Quebec, and that the payment of a higher tax is accordingly justified. The limit to which this taxation can go, however, is in critical relation to the nullification of industrial expansion in the territory to which it applies.

Taxes in Ontario

Here it is important to refer to Figures 13 and 14, pages 117 and 119, Part II, which show taxation per capita for all towns in Ontario with populations of less than 25,000. First, for the case of those that do, and second, for those that do not take hydro-electric power. It is seen that the towns taking hydro, carry a higher taxation, and this confirms the conclusion that exempting hydro investment from taxation merely amounts to a redistribution of tax, with a higher rate per capita.

The availability of power naturally creates a greater industrial activity, and centralized population, which latter in turn creates a demand for increased public accommodation, and the exemption of hydro from taxation (except land) is reflected in an increased tax rate per capita.

Taxes Received from Electric Utilities

As stated elsewhere, the elimination of taxes in so far as they apply to the supply of power, does not make for a reduction of the cost of that power to the people. It merely amounts to a redistribution of an equal amount of money which the people are called upon to pay, or in other words, the whole people of the community are paying a tax on power, instead of only those that are using it. It has therefore been entirely proper in the consideration of the cost of power to the people of Quebec, California and New York, to eliminate taxes when comparing the cost of power to that produced in Ontario.

It is of interest, however, to show some of the taxes paid by the electric utilities in the districts other than Ontario. The taxes received from the principal private companies in the Province of Ontario amounted to 7.1% of their annual income, which affected the price of their power by 0.6 mills per kilowatt hour generated and purchased. For the privately-owned electric utility companies in the St. Lawrence Valley of the Province of Quebec, the taxes were 6.53% of the annual revenues, and affected the cost per kilowatt hour generated and purchased in the amount of 0.46 mills.

For the thirty-five light and power companies operating in the Niagara District of the United States, taxation was at 10.6% of their annual revenue and affected the price per kilowatt hour generated and purchased 0.9 mills. In California, two principal companies paid 7.7% of their annual revenue in the form of taxes.

For the population served, the thirty-five light and power companies in the Niagara District of the United States contribute for taxes \$1.44 per capita; in California, \$1.10 per capita.

The Queenston-Chippawa Development

Of marked importance in connection with the adequacy, reliability and cost of power as furnished by the Hydro-Electric Power Commission to the municipalities is the Queenston-Chippawa Development, this development being entirely associated with the Niagara System. Section B, of Part II, deals with the growth of power capacity from the inception of the Hydro-Electric Power Commission to the present. On December 28th, 1921, the first hydro-electric unit in the Queenston plant (the largest in the world) was placed in operation. As therein shown, the original plan of the Ontario Power Commission contemplated the construction of a hydro-electric station at Niagara up to a possible development of 100,000 horsepower, and it was estimated that the cost of energy for such a plant would be \$4.95 per horsepower year. This was in 1906. This plan, however, was canceled in favor of the purchase of power from the then privately owned Ontario Power Company, and a contract was made for the supply of energy up to 100,000 horsepower, for which \$9.40 per horsepower year was to be paid up to the first 25,000 horsepower, and \$9.00 per horsepower year for the balance.

By 1915 it was necessary to negotiate for additional power and the Commission contracted with the Canadian-Niagara Power Company at the Falls for 50,000 horsepower, at a price of \$12.00 per horsepower year. In 1917, the Commission purchased the Ontario Power Company, and immediately extended the plant capacity of 162,000 horsepower to 202,000 horsepower, which is the present rating of that development. During this period of years, the Hydro-Electric Power Commission still held in mind the construction of a plant as originally conceived, and as early as 1913 preliminary plans and surveys were made for the construction of a hydro-electric station with a capacity of 100,000 kilowatts, utilizing a gross head of 317 feet between Lake Erie and Lake Ontario. In 1917, bids were advertised for the construction of what has since come to be known as the "Queenston-Chippawa Development," this hyphenated name being derived through the utilization of the Chippawa River as a part of the power canal, and the location at Queenston, on the Niagara River, where the development is being made. For reasons explained in Part II, the Commission itself in 1917 elected to construct this great development, rather than contract for it. Its capacity has grown from the original 100,000 horsepower to the capacity now planned of 650,000 horsepower and, as previously stated, the first unit of 55,000 horsepower was placed in commission December 28, 1921.

In Part II of the report may be found a detailed description of the Queenston-Chippawa Hydro-Electric Development, so it will suffice to say here that the power canal is rated to convey 20,000 second feet to a point above the gorge at Queenston, where, when full development is completed, this quantity of water will be discharged through water wheels operating under a net head of 305 feet, five units of which will have a capacity of 55,000 kilowatts each, and five others each of 75,000 horsepower.

In an address delivered upon the occasion of the opening of the Queenston-Chippawa Development, Sir Adam Beck stated that the two 55,000 horsepower machines now installed would be supplemented as soon as possible with three others, each of the same capacity; the future larger machines to be installed as occasion for additional power might require.

Engineering Reports on Queenston-Chippawa Development

In this Section of Part II, reference is made to reports by Messrs. R. D. Johnson (of Johnson and Wahlman), Hugh L. Cooper and Francis Lee Stuart, all consulting engineers of New York City. I have had opportunity to review these reports, and, in a second report of Mr. Cooper, supplemented with a letter of transmittal to Sir Adam Beck dated August 7th, 1920, he estimates the construction cost of \$66,423,418 for the completion of the first five units, totaling 273,000 horsepower, and a total of \$76,636,631 to carry the capacity of the station up to 495,000 horsepower. Mr. Cooper also makes

certain recommendations in respect to procuring additional water diversion above Niagara Falls, owing to the lack of adequate water supply which obtains under the existing international treaty between Great Britain and the United States.

Water Available for the Queenston-Chippawa Development

Referring to the Great Britain-United States international agreement now in force with regard to the diversion of water at Niagara Falls, it is important, upon the basis of the amount of diversion allotted to Canada, to review the original contracts of the Canadian power companies with the Queen Victoria-Niagara Falls Park Commission, and beginning page 130, Part II, a presentation of the facts is made from which is deduced the number of second-feet now available to the Chippawa Power Canal based upon the rights in the treaty aforementioned; first, under the provision that no water is diverted from the existing hydro-electric developments upon the Canadian side, and, second, upon the basis that water is diverted from these developments. At this juncture, it is of importance to point out that as the Queenston-Chippawa Development will operate under a net head of 305 feet as against, for example, the gross head of 215 for the Ontario Power Company, the number of horsepower per second feet obtained, for the Chippawa Development will be 29.4 as against 14.6 for the Ontario Power Company. Naturally, therefore, under limitations of total diversion above the Falls, the Chippawa Development should be favored.

The treaty agreement between the United States and Great Britain, as in operation today, permits the total diversion of 36,000 second feet on the Canadian side. Under Public Resolution No. 8 of the 65th Congress of the United States, the Secretary of War was directed to make a comprehensive investigation of the diversion of water from the Great Lakes and the Niagara River. The report resulting from this investigation was completed and transmitted to the Secretary of War on November 9th, 1920, by Major-General Lansing H. Beach, Chief Engineer of the U. S. Army, and contains the reports of Brigadier-General H. Taylor, U. S. A., Senior Member of the Board, and Colonel J. G. Warren, U. S. A., Division Engineer, Lakes Division. It appears, therefore, in review of the facts as presented in Section F of Part II, that upon the present treaty relations, with no diversion from the existing hydro-electric companies at Niagara, that there will be available for the Chippawa Canal 575 second feet of the 20,000 required when the ultimate development at Queenston is completed. If, however, the recommendations as made in General Taylor's report that the diversion on the Canadian side be increased from 36,000 to 40,000 second feet, then there will be available to the Chippawa Power Canal 4,575 second feet.

I have felt it incumbent to adhere to the total diversion as prescribed and now in operation under the existing treaty relations, for it should be ap-

parent that any diversion of water from the existing hydro-electric developments on the Niagara River calls for the amortization of generating equipment which, under such conditions, would be put out of commission.

Estimated Construction Cost of Queenston-Chippawa Development

Coming now to the estimated construction cost of the Queenston-Chippawa Development and its effect upon the cost of power to the municipalities—Sir Adam Beck states that the Commission has not estimated the cost of completing the ultimate development, but for the completion of the first five units totaling 275,000 horsepower, the Commission estimates the cost to be \$60,000,000, the exact figure depending upon the salvage received for the construction plant by which it was built. This figure, therefore, has been used as that applying to the Queenston-Chippawa Development. The fixed assets of the Ontario Power Company, purchased by the Hydro-Electric Power Commission as of October 31st, 1920, were stated to be \$28,757,614. The two developments, therefore, aggregate 477,000 horsepower and represent a capital investment of \$88,757,614.

Allowing 30 horsepower per second feet for the Queenston-Chippawa Development, the following diversion to the Chippawa Power Canal is required for the development of power in the figures named:

<i>Horsepower</i>	<i>Second Feet</i>
275,000	9,167
540,000	18,000
600,000	20,000

Based on General Taylor's report regarding present permissible diversion of water on the Canadian side, in order to develop the full 275,000 horsepower in the Queenston Plant it will be necessary to divert from the Ontario Power Company water which, when measured in power, represents 125,500 horsepower, thus leaving an effective capacity for the two plants of 351,500 horsepower, and, under conditions of approved operation, it would be expedient to have in reserve generator capacity one of the large generating units now installed at the Queenston Power Station, which, being 55,000 horsepower, would then yield a total generator capacity of 406,500 horsepower. This reserve capacity, however, should not be confused with effective capacity, since the available water would not permit production in excess of 351,500 horsepower.

Upon the basis of the above figures, the total investment per installed horsepower without reserve would be \$252, while the investment per horsepower with reserve capacity would be \$218.

Estimated Cost of Power from Queenston-Chippawa Development

In Part II is shown an accounting for expenditures covering interest upon investment, administration, maintenance and operation, water power rental, insurance, renewal reserves and sinking fund,

with a total estimated annual production cost of \$8,834,000. Existing commitments on the part of the Hydro-Electric Power Commission call for the sale of power, outside of that for the municipalities, of 108,000 horsepower, the income from which is \$1,278,000. The available horsepower to the municipalities is therefore reduced by this amount and operating expenses credited to the extent of income received therefrom. Dividing, therefore, \$7,556,000 by 243,500 horsepower, the net horsepower available to the municipalities gives the average cost for power production to the Niagara System at the buses of the generating plants at \$31.10 per horsepower year. In connection with this figure, it must be remembered also that it is assumed that the municipalities are in a position to accept the full amount of power generated, for otherwise this figure will be increased. As previously stated, this figure of \$31.10 per horsepower year as the cost of power to the municipalities is based on the diversion of water at Niagara Falls in accordance with the existing treaty between the United States and Great Britain, and, as shown in the presentation of this matter in Part II, the diversion of water to the Chippawa Power Canal renders ineffective a capacity of 125,500 horsepower in the station of the Ontario Power Company.

Through the diversity existing between the power purchased by the municipalities and the corresponding peak impressed upon the generating plants at Niagara Falls, this will reduce the cost to the municipalities by 15%, thus changing the figure of \$31.10 per horsepower year to \$28.05 per horsepower year. Adding to this latter figure the cost incident to the transmission of power from Niagara to the municipalities, as taken from the Commission's statement for the fiscal year 1920 at \$9.40 per horsepower year, the total wholesale cost of power to the municipalities and companies of the Niagara System, taking power to the extent and under the conditions enumerated, will be \$37.45 per horsepower year.

The portion of the plant of the Ontario Power Company made ineffective through diverting water to the Chippawa Power Canal is about 35% of its total capacity, and an amortization rate of 9% has been used for this portion of the investment, while for the balance, 65% of the capacity, the same rate for renewals has been taken as was used by the Commission's engineers.

Summating, the estimated cost for power delivered to the municipalities and companies of the Niagara System of \$37.45 per horsepower year is an increase over the cost of \$19.80 per horsepower year stated by the Commission in their 1920 Annual Report of \$17.65 per horsepower year, or in percentage 89%. The increase in production cost per horsepower year at the point of delivery to the Niagara System from \$10.40 for 1920 to \$28.05 amounts to approximately 170%.

If General Taylor's recommendations that 40,000 second feet be assigned as the Canadian diversion is approved by the two governments, then the cost

of power to the municipalities, the detail of which is presented on page 138, Part II, of the report, is seen to be \$29.80, which is an increase of \$10.00 over the cost as stated by the Commission in its 1920 Annual Report, or 51%, and in the case of the actual production cost of power at its delivery point, it is seen to be \$20.40 as against \$10.40 for 1920, being an increase, therefore, of 96%.

Again referring to Part II, beginning page 139, the estimated annual production cost is shown for power delivered to the Niagara System and the municipalities, as developed from a 575,000 horsepower installation at Queenston in combination with power supplied from the Ontario Power Company, all based upon the diversion of water to the extent of 40,000 second feet as recommended by General Taylor. In this computation it is seen that the total wholesale cost per horsepower year for power to the municipalities and companies of the Niagara System, when taking power to the extent and under the conditions enumerated, will be \$31.70 as contrasted with power received by them at \$19.80, this showing an increase of 60%, while the increase in the production cost per horsepower year at the Falls will be from \$10.40 as stated by the Commission for 1920, to \$22.30, or an increase of 114%.

Finally, it seems of importance to show what the effect upon the cost of power to the municipalities will be upon the basis of an unlimited supply of water to all of the existing Canadian hydro-electric developments, and to the Queenston Development—first, based on the latter's development to 275,000 horsepower, and, finally, to the full estimated capacity of 650,000 horsepower, which capacity the engineers of the Hydro-Electric Power Commission claim is possible. To show this, a similar course of procedure is followed, which is detailed in Part II, page 140, and it is to be noted that the total wholesale cost for power per horsepower year purchased by the municipalities and the companies of the Niagara System, when taking power to the extent and under the conditions enumerated, will be, first, upon the basis of 275,000 horsepower developed at Queenston, \$27.90 per horsepower year, and when 650,000 horsepower is developed at Queenston, then \$20.35 per horsepower year.

Upon the first basis, namely, 275,000 horsepower at Queenston, the cost of \$27.90 per horsepower year is greater by \$8.10 than the cost stated by the Commission in their 1920 Annual Report, of \$19.80 per horsepower year, and is therefore an increase of 41%. When the full development is made at Queenston, then the increased cost of power to the municipalities will be approximately 3%.

The cost of power production for the Niagara System may be well visualized by reference to Figure 17, page 141. When the Queenston-Chippawa Plant is constructed to a capacity of 275,000 horsepower, and has an unlimited supply of water available to it, the cost of power at the plant's buses will be \$21.30 or an increase of 65% over that cost at which the Ontario Power Company was producing power in 1920, and it is apparent that it will not be

until the full projected development at Queenston is completed that this cost will be comparable with that of the Ontario Power Company's production of power in 1920. However, at that time, the Ontario Power Company's power cost will probably be less, due to reductions in labor and material that will have taken place by that time.

The Results from the Queenston-Chippawa Development

The Queenston - Chippawa Development was planned before the World War, and its construction prosecuted throughout the period of the war. This report would lack in point of constructive criticism not to refer to the policy of this procedure. With the costs of labor and material mounting to unheard-of figures, with the efficiency of labor at its lowest ebb and with the magnitude of the undertaking making it impossible to complete construction to promptly meet war demands, as evidenced by the first unit having only recently gone into operation, I cannot escape the conclusion that this policy was wrong and that the burden of its costs must now be felt in a very material increase of cost to the municipalities of Ontario for many years.

The Nipigon Development

The building of the Nipigon River development for the Thunder Bay system by the Hydro-Electric Power Commission has been much discussed. It was especially desired that the facts be ascertained concerning the Hydro-Electric Power Commission's reasons for this development.

The first two generating units of this plant have been installed and they aggregate 25,000 horsepower. The plant is designed for an ultimate capacity of 75,000 horsepower. The expenditures made in connection with its construction as of October 31, 1921, as stated by Mr. Gaby in Section A, are \$6,387,136.56.

Port Arthur, located on Thunder Bay, with a population of 15,094, receives its electrical energy from the Nipigon development, the distance of the power plant from the city being 69 miles, while farther to the west and also located on Thunder Bay is the city of Fort William with a population of 19,886, receiving its electrical energy from the Kaministiquia Power Company, whose source of power is a hydro-electric development on a river of that name, with a plant capacity of 35,000 horsepower and distant from Fort William about 18 miles.

The mooted question having regard to the building of the Nipigon Plant at a time when the Kaministiquia Power Company was under agreement to supply Port Arthur and had in reserve a sufficient amount of power to cover the power needs of the Thunder Bay district, inclusive of the Fort William load, is the subject reviewed in Section G of Part II of this report.

The Cost of Power from the Nipigon Development

In reviewing the situation, I am unable to escape the conclusion that there were no economic grounds

justifying the construction of the Nipigon Works. The capacity developed on the Nipigon River, plus that available from the Kaministiquia Power Company, provides the people of the Thunder Bay district with three horsepower per capita. This is five times the per capita capacity of that available from all sources, private or governmental, to the people on the Niagara System, and on the basis of the ultimate proposed development for Nipigon and the Queenston-Chippawa plant, then the amounts available per capita to the Thunder Bay district will be nearly four times as great as that on the Niagara System. When comparison is made of the industrial character of these two territories, the over-development at Nipigon becomes apparent. Over-development, of course, reflects greatly into cost of power. The city of Port Arthur purchased from the Commission during the year 1920 an average of 7,030 horsepower, and this, upon the basis of the Power Commission Act, makes the municipality of Port Arthur liable for power at \$83.00 per year at the buses of its substation.

Section 2 of the contract which the Commission held with the Kaministiquia Power Company shows that all power in excess of 6,000 horsepower would come to the Commission at \$14.00 per horsepower year, with the contract holding (Section G, page 144) for forty years.

Power Available to the Thunder Bay District

While the number of square miles of drainage area above the Nipigon development is about three times that above the Kaministiquia development at present, it lacks a storage equal to that available to the Kaministiquia plant, and every second foot of the Kaministiquia development develops more than twice as much power as that developed at Nipigon, due to the Kaministiquia head being more than twice that of the Nipigon. I am therefore unable to escape the conclusion that the cost of power to the people of the Thunder Bay district would have been far less had the Commission continued in force its contract with the Kaministiquia Power Company, rather than proceeding with the development at Nipigon, especially in view of the fact that other developments are possible, when required, on the Kaministiquia River to supplement those already made. Upon this basis, the Nipigon River could have been held in reserve for power development in event of the district developing a requirement for such a procedure.

For a more detailed review of this situation, especial reference is made to Section G of Part II of this report.

Hydro-Electric Power Commission's Rate Structure

The rate structure as adopted by the Hydro-Electric Power Commission is remarkable because of its complete dissimilarity to anything in existence.

By the Power Commission Act and its amendments, the Hydro-Electric Power Commission is given authority to:

- (a) Adjust the wholesale rates to the several municipalities taking power at the end of each year, so that these rates shall represent each municipality's proportional cost for service.
- (b) To make and regulate the retail rates that shall be charged by the municipal commissions to the individual customers taking power therefrom.
- (c) To make rates to companies located without the precincts of the municipalities and with the permission of the municipal commissions to make rates to companies located within municipal precincts.

The Power Commission Act does not grant the Hydro-Electric Power Commission any authority over the rates that shall be charged by power companies privately owned and operated.

Power at Cost

The California utilities are required to sell their power to their customers at cost. "At Cost" in California includes taxes and cost of money. "Cost of money" in California includes both bond interests and dividends on the equity portion of the investment.

"At Cost" in Ontario eliminates taxes on electric utility properties, except land, and all dividends are eliminated, since the properties controlled by the Hydro-Electric Power Commission are built exclusively on borrowed money raised by the sale of the Commission's bonds and guaranteed by the Provincial Government. With these qualifications, the rate-making methods of California and Ontario are the same. Application, however, is entirely different.

In Section H, Part II, hypothetical examples are set forth showing the methods as prescribed by the Hydro-Electric Power Commission, and in California, relative to determining the wholesale cost of power to the consumer.

Rate Methods Applied in Ontario and California

In Ontario, each system (eight of which are in operation) has a power center. Immediately in the vicinity of that center, the cost of power is minimum. At the point farthest from the power center (measured in transmission distance, not distance in a straight line) the cost is maximum. For example, in 1920 the interim rate for power at Niagara Falls was \$11.50 per horsepower year, while at Windsor, 235 miles away, the cost was \$36.00 per horsepower year. It is interesting here to point out that the several systems of the Hydro-Electric Power Commission overlap zones taken about Niagara Falls as a center, and power sold to a municipality from one system may be at a price over 500% higher than that sold to a municipality within the same zone, but receiving power from another system. In this regard, it is of interest to refer to Plate 4, page 165. Here we see this point illustrated in noting the Niagara, Eugenia and Severn Systems supplying power in the same zones. The Power Commission Act requires the power to be sold at cost. Niagara

is naturally the system producing its power at the lowest cost. Its transmission is the longest of all and in passing through the zones also furnished with power from other systems, while costs in transmitting for the Niagara System are heavy, due to the longer distance, yet the other systems have to sustain a higher production cost at their source of power, which overbalances the transmission cost incident to the Niagara System.

In California and in other States of the Union, as well as in Quebec, it is the aim to equalize costs. This is upon the basis that just because power must always be cheaper at its source, due to the elimination of transmission, it has been considered good policy not to penalize the more distant consumers by pyramiding the cost to them simply because they have chosen these locations for such reasons as better harbor and railroad facilities, etc., etc.

Result of Hydro Rate Methods

Indeed, the actual application of the wholesale rate-making methods employed by the Hydro-Electric Power Commission of Ontario has resulted in a widely varying wholesale cost of power to the municipalities, placing at a disadvantage those municipalities which are not near the source of power or near the main lines of the systems. Even wider variation is found in the rates for power sold directly by the Hydro-Electric Power Commission to individual companies.

Comparison of Wholesale Interim and Actual Rates

The Commission uses an interim wholesale rate. It is an estimated rate to the municipalities and at the end of the year the municipality is credited or debited, depending upon whether the actual cost has been respectively lower or higher.

In the 1920 annual report of the Commission, the interim wholesale rates for 169 municipalities are given, while the actual wholesale rate paid can be computed for 174 municipalities. The highest interim wholesale rates that were quoted in this report were between \$80.00 and \$90.00 per horsepower year, while the highest actual wholesale rates paid per horsepower were between \$150.00 and \$160.00 per horsepower year. Altogether, there were nine municipalities which paid a rate higher than the maximum interim rate quoted.

One Price for Power

I am unable to follow Sir Adam Beck's statement before the Water Power Commission of the House of Representatives of the United States in 1918 when he said:

"The small user buys electricity at the same price as the large user. There is a standard rate in every community which applies whether you use 10 horsepower or 10,000 horsepower."

I should be glad to be corrected if I am wrong in stating that this is at variance to the "Standard Interpretations of Rates" (Cir. 160315) laid down by

the Hydro-Electric Power Commission, as well as to the facts presented in Volume II of the Commission's Operations for 1918. At this juncture it is important to point out that a customer contracting with the Commission for power has no guarantee except for one year (and that based on the prevailing rate) whether his power is going to cost him more or less at the end of the second year. The rate structure, as described in detail in Section H, shows that this must be so, and in view of the wide rate variations which are perfectly possible, especially in the less populated districts, it makes it impossible for customers of power to definitely figure its cost in the manufacture of their several products.

Touching upon the sale of power directly to the customers by the municipalities, Figure 21, page 175, brings out the fact that the consumers of power from the municipality of Toronto are paying 11% more for power at 15% load factor than those receiving power at London, Ontario, yet, when the load factor increases to 50%, the Toronto power user pays 42% more than does the London consumer. It is difficult to understand such a power schedule.

Rate Discrimination in Ontario

It is very plain that the method pursued both in respect to the physical location of transmission structure and the plan of pyramiding costs upon them to the people as their distance becomes greater from the source of power generation, together with the fact that the systems are separately operated, must automatically lead to discrimination in rates. The purchase of the Ontario Power Company, carrying its long-term low-priced contracts for power (it being sold at below production cost); the purchase of the properties in the "Clean-up Deal," inaugurating two rates for power in a single city from one corporate supply; all of these conditions, in combination with a determination to give the people power "at cost," lend a complexity to the situation which makes it impossible to determine whether or not power is sold "at cost."

The "Clean-up Deal" and its effect upon the cost of power to the consumer will be a new chapter for Volume II of the Commission's annual reports, and as yet we have not come to that. The problem assigned included the determination of the actual cost of power to the people of Ontario as compared to that in the States and in the Province of Quebec. That cost with comparisons is given in Section I, Part II.

Theory of Government Ownership

A popular notion exists on the part of a small minority in this country that governmentally-owned properties offer public service in the electric utility field at less cost than that offered by privately owned properties, and base it on the assumption that costs in the production of power are reduced through the elimination of taxes, dividends, high-salaried executives and high-priced and inefficient labor.

Fortunately, the majority of the people in the

United States, recognizing the necessity of efficient organization and administration, have neither subscribed to nor practised this theory. However, upon the basis that there may be something in it, it has been the purpose of this report to present the facts, and no place in the world offers an opportunity in which the contrast can be so well drawn between governmentally owned and operated electric utilities and privately owned and operated utilities, as in the Provinces of Ontario and Quebec for Canada, and California and the Niagara District of New York for the States.

Sections Selected for Comparison

The Dominion Bureau of Statistics shows that the Province of Ontario in 1920 owned approximately one-half of its electrical utilities, and of the total utility income two-thirds was derived from those governmentally-owned, while in Quebec, the government-owned utilities, representing but 4% of the investment in that class of property, receive about 5% of the total revenue therefrom.

New York has been selected because its northwest section lies adjacent to the Niagara Falls hydro-electric power developments in Ontario; Quebec, because, as in Ontario, power in large bulk is developed by hydro-electric plants and they, in contrast to Ontario, are owned by private interests. California has been selected because its principal supply of power is from water power sources.

I am far from the opinion that the Hydro-Electric Power Commission of Ontario provides an instrumentality as satisfactory for the control of the government electric utilities of Ontario as do the Public Service Commissions for the electric utilities in the States, but for the moment, granting that it does, and equating adequacy and reliability of power to the people of the Province of Ontario, it is now pertinent to make a comparison of the costs of power to the people of Ontario with the costs of power to the people of the States and the Province of Quebec.

In this regard, I would especially refer to Section I, Part II, of this report, in which is given these several costs. Referring to that section of the report, it is important to remember, as stated elsewhere, that Niagara Falls, combining its continuous flow of water with its high head, should make the production of continuous power the cheapest for any part on the American Continent. This should be kept in mind especially when the comparison is drawn for the California situation, where the hydro-electric power developments are small in capacity and subject to variation in stream flow, thus requiring that their systems be supplemented with steam electric plants.

It is only fair to California, in making a comparison of its power costs to those for Ontario, to point out the fact that Ontario, as of 1920, had in miles of transmission lines but 35% of the total mileage for California as of 1919, and, further, that the California transmission served only 483 inhabitants

per mile as against 587 inhabitants per mile for Ontario.

It is also in keeping with a fair analysis of the situation to point to the accomplishment of the private and publicly-regulated electric utilities in California which are making energy available to their customers at a cost less than that for energy from other than the Niagara system in Ontario, notwithstanding the physical difficulties they have to surmount in transmitting the power over long distances from comparatively small water powers of variable flow, supplemented to the extent of 41% by steam electric plants. The private electric utility companies have been able to accomplish these results only through efficiency in the utilization of capital and efficiency in management. This is instanced by the most extensive interconnected transmission system in the world, extending from Oregon to Mexico.

It seemed especially important to establish relatively the facts pertaining to the distribution of power to agricultural territory in California and Ontario. A legislative committee of the Legislative Assembly of Ontario reported on November 30, 1920, that of the total of 337,170 horsepower sold by the Hydro-Electric Power Commission of Ontario, 2500 horsepower, or less than 1% of the total, was sold to agricultural industry. On the other hand, in California, about 500,000 horsepower was delivered to agricultural industry by the privately owned electric utilities in 1920, which amounts to about 13% of the entire connected load.

Relief from Taxes

With regard to the relief from taxes, in the matter of government-owned electric utilities, it should be patent that no such relief really exists. The people in reality are taxed just as much. The lifting of the taxes from the government-owned electric utilities merely amounts to a redistribution of tax; i. e., more mills per dollar of valuation are paid on other property.

Power Costs in Quebec and Ontario

Referring to Table 20, page 183, this shows that the cost of power to the entire people of the Province of Quebec is less than that to the people of Ontario, and it is interesting to note the higher productivity as gained from salaries and wages paid in that Province. The revenue per dollar of salaries and wages paid is also seen to be 32.5% greater in Quebec than in Ontario.

Power Costs from Government and Private Electric Utilities in Canada

The Dominion Government prepares statistics for the privately-owned and governmentally-owned electric properties. Tables 20 and 22, pages 183 and 185, respectively, especially relate to Ontario and Quebec, while Table 21, page 184, relates to the whole of Canada. Where the investments are principally in properties of like character, namely, water powers, the greater revenue earned per dollar of investment

by the governmental electric utilities indicates that the rates charged for service must be higher, or a deficit against the properties must be recorded. However, no deficit is recorded. In other words, this means the governmentally-owned electric utilities must charge a greater rate for power to meet the greater expense incurred in the generation and delivery of that power.

In respect to economic operation as between government-owned and privately-owned electric utilities in Ontario and Quebec, it is of especial importance to refer to Tables 22 and 23 on page 185 of Part II. Here is shown the operating ratios between the privately-owned and governmentally-owned companies indicating a much lower per cent for the former.

The real measure of efficiency of an organization is not so much what might be the average salary or wage paid, as what is the revenue earned per employee. Here it is seen that the revenue earned per employee for the private electric companies of Ontario was 31.5% greater, and for the private companies of Quebec 42% greater, than for the governmentally-owned and operated properties of Ontario, and, further, not only the revenue per employee is greater for private operations than for governmental, but the revenue per dollar of salaries and wages paid is also much larger for the private companies than for those operated by the government.

Average Cost of Power to the Ultimate Consumer

Analyzing the actual average cost of power to the consumers per kw-hr. generated, the following comparisons in Section I, Part II, are given:

In the Niagara district of Canada the government-owned electric utilities furnish this power at 9.25 mills; the private electric utilities of this district furnish it at 7.6 mills per kw-hr. generated, and the weighted average of these two supplies is 8.78 mills per kw-hr.

In the United States, for a comparable zone supplied by Niagara Falls power, the average price of power to the consumer is 7.65 mills per kw-hr. generated. In the Province of Quebec, where power to the extent of 96% is generated by private electric utilities and where the general zone of transmitted power is not unlike that of Ontario, the average cost to the consumer per kw-hr. generated is 6.6 mills.

While the average price for power from government electric utilities in the Niagara district is 9.25 mills per kw-hr. generated, the purchase of the Ontario Power Company, by the Hydro-Electric Power Commission, with its existing contracts to supply power to the American and Canadian companies at 2.53 mills results in the Canadian municipalities of the Niagara System paying 11.1 mills per kw-hr. rather than the average price of 9.25 mills above named.

From these figures, it is apparent that both in Quebec and the United States the average price of power to the consumer is less per kw-hr. generated as produced by private companies than for that produced by the government-owned utilities. In the

several considerations taxes have been deducted, but the price of power to the consumer in the case of the privately-owned companies, either in the Provinces of Quebec or in the United States, has included such profits or dividends as may have resulted from the conduct of their business.

Whatever may have been the high salaries paid for executives, or whatever may have been the profits or dividends accruing in the conduct of the business affairs of their several companies, it is manifestly plain that inclusive of these the price of power to the consumer has been less, which, in my opinion, makes it very apparent that a far higher order of organization and administration exists in private rather than government-owned electric utilities.

The Niagara Power Districts in Canada and United States

In comparing the districts lying close to Niagara Falls in the States and in Canada, the population served in the Canadian districts is 1,200,000, while that of the United States district is 1,500,000. The American area, however, is smaller and more energy per capita is used. In the States 39% of the generating capacity is steam, while in Canada the amount of steam capacity is about 15%. Part II of the report, Section I and Figure 24, page 191, furnish the detail of the power characteristics of these two zones.

The average cost of power, that is, the revenue per kw-hr., generated for the American Niagara Power district, is about 17% less than that for the total operations of the Hydro-Electric Power Commission and the Municipal Commissions for wholesale power delivered in the Canadian Niagara district, and it is about 13% less than that for all the electric utilities in that district, whether they be governmentally or privately operated.

Comparing the average cost of retail power to the people residing within the municipalities served by the Hydro-Electric Power Commission in the Niagara district, it is found that the average cost of power to the people in the American district is less by about 4.45 mills per kw-hr. and 40% in percentage.

It is also important to note that in the American Niagara district, for each 1,000 of population, a capacity of 65% in excess of that in Canada is used. This greater capacity, therefore, contains reserve against interruption of service, and notwithstanding a very considerable percentage of capacity is steam-operated, the cost of power to the consumers per kw-hr. generated on the American side is less.

California Compared to Ontario

In California, electricity is produced and transmitted under far more disadvantageous conditions than those obtaining in the Niagara district of Ontario. In California, 41% of all the generating capacity is represented by steam-electric plants. Obviously, therefore, such a physical situation does not lend itself to the production of cheap power to the

extent possible by the electric utilities receiving power from Niagara Falls. In California, the transmission distances are great, the lines must pass across very rugged country and the stream flows are comparatively small and subject to extreme variations.

In Part II, Figure 25, page 193, is shown the total revenue from energy generated per capita, and the proportion of the capacity in water power for California compared to the same statistics in respect to the systems other than the Niagara operated by the Hydro-Electric Power Commission of Ontario. In this comparison, it is seen that the average cost of power to the people of California is less by 4% than that to the people served by the systems other than the Niagara in Ontario.

Quebec Compared to Ontario

Though stated before, here again it may be emphasized that in consideration of equal volumes of power produced there are no hydro-electric situations offering physical conditions on the North American Continent which permit equal economic opportunity to those at Niagara Falls. However, in the Province of Quebec, we find a physical situation somewhat approaching, and in this Province the electric utility policy is dictated by the officers of privately-owned, rather than governmentally-owned, properties.

The number of people within reach of Hydro-Electric Service in Ontario is 1,180,300, while in the St. Lawrence Valley of the Province of Quebec this number is 1,100,000.

The analysis shows that the average cost of power to these people of Quebec is 32% less per kw-hr.-generated than the cost to all the people receiving Hydro-Electric power in the Province of Ontario, while it is 27% less than to the consumers in the Canadian Niagara district, whether they are served by government or privately owned electric utilities.

The private companies in Quebec deliver 84% more energy per capita than does the Hydro-Electric Power Commission to its customers in Ontario, while the generating capacity available per 1,000 of population is greater by 89% than that available upon the lines of the Hydro-Electric Power Commission in Ontario. These comparisons are illustrated in Figure 26, page 195.

Lower Average Prices to Consumers of Private Companies

In the mentioned districts of Canada and the United States I find that the privately owned and operated companies in every case are delivering power to their consumers at a considerably lower average cost per kw-hr.-generated than is the case for government electric utilities; that the number of kw-hrs. generated per capita served is greater, and that the number of customers taking a service for each 1,000 of population is greater, while standing behind the privately owned service is also a larger reserve equipment to insure a continuity of service.

Power Costs in Ontario, Buffalo and Montreal

Section I, Part II, of the report, deals with the comparisons of the cost of power to the people residing in the larger cities in the Provinces of Ontario and Quebec, and in the Niagara Power District of the United States.

I would especially refer to the text of this section of the report and the figures therein presented for a more comprehensive appreciation of the situation. The distribution of power with regard to commercial and domestic lighting and industrial requirements is also discussed in Section 1.

Toronto, which is the largest city receiving service from the Hydro-Electric Power Commission of Ontario, is compared to Montreal, the largest city of the Province of Quebec, and to Buffalo, the largest city in the Niagara district within the United States.

Toronto is located about 80 miles from Niagara Falls, while Buffalo is within 20 miles of the same point. Montreal receives its power from Cedars Rapids and from Shawinigan Falls, and the distances over which power must be transmitted from its point of production to that of utilization are comparable to the distance between Toronto and Niagara Falls.

In 1920, the Hydro-Electric Power Commission supplied Toronto without the use of any steam electric reserve located within that city. Montreal and Buffalo do have steam electric reserve, and in the latter city the steam electric plant produced in 1920 over 180,000,000 kw-hr.

Revenue less taxes per kw-hr. have, in all instances, been compared, but the energy in this instance is taken on the basis of that sold to the ultimate customer rather than that generated in the power plants. Figure 27, page 199, shows the total revenue less taxes per kw-hr. sold compared for these three cities. That for Toronto includes only the operations of the local Hydro-Electric Power Commission. The cost of power to consumers in Toronto was about 1.78 cents per kw-hr. in 1913. It was gradually reduced until 1918, when it reached a minimum of 1.02 cents. Since that time it has risen until 1920 to 1.47 cents per kw-hr.

For 1913 and 1914 the average cost of power to consumers in Buffalo was quite high, being over 3.25 cents per kw-hr. This was due to the small proportions of power business to the total business. However, in 1915, a very material drop in average price took place and the average cost of energy in Buffalo reached a minimum of 0.93 cents in 1918, since when it has risen to 1.18 cents per kw-hr. in 1920.

The average cost of power to consumers of Montreal has been very uniform over the eight-year period analyzed, starting at 1.03 cents in 1913 and reaching a minimum of 0.93 cents per kw-hr. in 1917, with an increase since that date to 1.13 cents per kw-hr. for 1920.

For 1920, the average cost of power delivered to the customers of the Toronto Hydro-Electric Power

Commission was 29% greater than that to the people of Montreal, and was 25% greater than that to the people of Buffalo.

The increase in the average cost of energy in the several cities, brought about by increases in the cost for labor and material since 1917, have been 25% for Montreal, 27% for Buffalo and 44% for service from the Toronto Hydro-Electric Power Commission.

The Toronto Hydro-Electric Power Commission furnishes a relatively small amount of power to the civic street railway lines, and it furnishes only in part the domestic and industrial light and power business in the city of Toronto. In order to compare the average cost for power to all of the people receiving electric service in Toronto to that of Montreal and Buffalo, the revenues from energy sold by the private company, including the cost of power to the street railway company, has been added to that of the Toronto Hydro-Electric Power Commission for the city of Toronto, and the comparison as to the revenue less taxes per kw-hr., between these several cities is illustrated in Figure 28, page 201, for the years of 1917 to 1920 inclusive.

This figure indicates that the Toronto Hydro-Electric Power Commission was selling power in Toronto at an average cost to people less than that for the private companies in Toronto up to 1920, when the higher rates put into effect by the Commission increased the average cost to a point above that of the private company.

The combined revenue less taxes for the city of Toronto per kw-hr. sold for the private company is 1.35 cents as compared to 1.47 cents for the operations of the Toronto Hydro-Electric Power Commission only.

The Cost for Street Lighting in Toronto, Buffalo and Montreal

The cost for street lighting in Montreal is shown to be about 40 cents per capita, varying in a number of years but a little above or below that figure.

In Buffalo the price has changed very slightly, ranging from 53 cents per capita in 1913 to 60 cents per capita in 1920.

The cost for street lighting per capita in Toronto, in each instance, is higher than that of the two other cities and shows a greater variation from year to year, ranging from approximately 80 cents in 1917 to about 63 cents in 1918, the figures of 1920 showing the cost to be 67 cents.

Figure 30, page 205, shows the proportional amount of total revenues received from the different classes of service by the Hydro-Electric Power Commission as compared to the city of Buffalo. For the past few years, the proportion of the total revenue received in power sales is not far different, while that proportion received from domestic and commercial lighting is somewhat greater for Buffalo than for Toronto.

Figure 30, page 205, indicates that the cost of domestic and commercial lighting to the people of Toronto receiving service from the Hydro-Electric

Power Commission is not much lower than that to the people of Buffalo, receiving the same class of service.

Industrial Consumers in Ontario Carry the Burden

It is patent, however, that unless deficits in the Commission's accounts exist, that if the cost of power, taken as a whole, is more in the Province of Ontario than elsewhere, as the facts support, then the only explanation is that its industrial consumers are carrying the burden. A greater consumption of energy per capita in the territory other than that covered by Ontario confirms this.

The Relation of Capital Expenditures to Revenue

The efficiency of management of an electric utility may, to some degree, be gauged by the capital expenditure per dollar of revenue received, if the service rendered by the utility is on comparable conditions. This is particularly true when the relation is analyzed over a period of years, rather than for a single year. When the facilities for the production or distribution of power have been placed in operation, the fixed charges, therefore, must be paid from revenue, and accordingly it is obvious that if one utility shows a capital expenditure per dollar of revenue of much greater magnitude than another, under like conditions of operation, the utility having the higher ratio of capital expenditure to revenue must, of necessity, other factors being equal, charge a higher price for its product.

In this regard, especial reference is made to Figure 36, page 219, and the text in reference thereto. In connection with the operations of the Hydro-Electric Power Commission and those of the municipalities in Ontario, the capital additions in per cent

of revenue are greater by 200% than those for the American companies in the Niagara district, and by 350% than those for the Quebec companies, operating in the St. Lawrence Valley.

Un-uniform Power Costs in Ontario

The operations as applying to the utilities in the States and in the Province of Quebec provide for a more evenly distributed cost of power to their consumers. In Ontario, the customers of the Hydro-Electric Power Commission energy do not enjoy this uniformity of price. This is well illustrated in Table 24, page 216, in which it is to be noted there have been selected in pairs large municipalities located close to small municipalities in order to show the difference in cost resulting from the rate system employed by the Commission.

An example of this is the price paid for power in 1919 in the cities of Toronto and Bolton, where the figure was \$16.70 per horsepower year for Toronto, and \$53.80 per horsepower year for Bolton, notwithstanding the small distance apart.

The rate structure of the Hydro-Electric Power Commission is discussed in Section H, page 154, and must necessarily bring about such a result. It is my opinion that a rate structure so planned is fundamentally wrong, as it functions only to signalized specific points in the Province where power is available at minimum cost. The American method of equalizing the rates throughout an area eliminates premium on location; brings about decentralization and better opportunity of industrial expansion and healthier inter- and intra-state relations.

Yours very truly,

WM. S. MURRAY,

MURRAY & FLOOD.

PART II

Supporting Discussion of Facts Ascertained

SECTION A

Correspondence Between Mr. W. S. Murray and the Electric Utility Companies, the Hydro-Electric Power Commission of Ontario and Officials of the Province of Ontario

In undertaking to make this report it was necessary to have the co-operation of the officials of a number of the electric utility companies both in the United States and in Canada, and also of the Hydro-Electric Power Commission of Ontario. If these several officials had not co-operated, the report could not have been based upon fact, and it would have been of small value.

Mr. M. H. Aylesworth, Executive Manager of the National Electric Light Association, addressed a letter to a number of the member companies of that association requesting that these companies co-operate in furnishing information asked for.

It was vital to obtain complete information from the Hydro-Electric Power Commission of Ontario, and, accordingly, on September 9th a letter was addressed to Sir Adam Beck, Chairman of the Commission, in which was set forth the purpose of the proposed report. To that letter was attached a list of questions covering the information desired.

This letter, together with subsequent correspondence with the Hydro-Electric Power Commission, follows. The complete answers to the questions submitted to the Commission were not received until December 14th, although Mr. Gaby presented the answers to the large majority of the questions on October 21st. The questions themselves have been eliminated from the letter of September 9th for the reason that these have been repeated in the answers given by Mr. Gaby in his letter of December 14th.

COPY

Letterhead of
MURRAY & FLOOD

"Sept. 9, 1921.

"SIR ADAM BECK, Chairman,

"Hydro-Electric Commission of Ontario,
"Toronto, Ontario.

"MY DEAR SIR ADAM:

"I am very sorry not to have had the opportunity of seeing you yesterday, but spent a few minutes with Mr. Gaby, explaining the commission I have recently received from the National Electric Light Association, to investigate and report on the electric utility systems, as operating in the United States and by the Hydro-Electric Power Commission of Ontario.

"As stated to Mr. Gaby, when the Committee of the National Electric Light Association asked me to take up the work, I explained to them that on two occasions I had been retained by the Hydro-Electric Power Commission, mentioning to them the subjects upon which you had requested me to report.

Their attitude was, as a result of this explanation, even more pronounced, that my services be engaged upon their matter, particularly in view of the fact that my previous work for the Hydro-Electric Power Commission had been in connection with engineering and construction features, having nothing to do with the economic and political structure of the Commission's plans.

"The report I am to render, while having much to do with the two former subjects, is more particularly related to the political and economic structures, as existing in the States and in Ontario, and you will therefore understand that I would take an impossible position to refuse to attempt collecting the complete facts of both situations, and be governed in my conclusions by them.

"Accordingly, I am most anxious to see you.

"Knowing you, I know there is no frank question that I would ask you but that I would receive as frank an answer. Accordingly I have prepared a set of questions which are attached to this letter, and I would greatly appreciate having their answers, or a reference to the original data, from which they could be derived.

"If it meets with your approval, either I or my partner, Mr. Henry Flood, Jr., will call on Mr. Gaby promptly, to the end that we may be able to secure the information at the earliest possible date.

"Very cordially yours,

"(Sd.) W. S. MURRAY."

COPY

"WESTMINSTER HOTEL,
"TORONTO, Sept. 21, 1921.

"MR. F. A. GABY,

"Chief Engineer,

"Hydro-Electric Power Commission,

"University Avenue, City.

"MY DEAR MR. GABY:

"I want to say how much I appreciate your kindness in getting my numerous questions answered. I refer to those that were enclosed on the list attached to my letter of the 9th inst. to Sir Adam. I would, as you must know, greatly hesitate to press the early response I am seeking, except that all the utilities in the States are generously and accordingly responding, as it is the general desire that our report be submitted to the National Electric Light Association at the earliest possible date.

"In our chat at the King Edward on the 10th, I asked a question which I intended to include in the list I sent you, and may I ask you to include it therein. The question was:

"If, as in the United States, there had existed in Ontario a Public Service Commission for the purpose of controlling the rates and issuances of the public electric securities, thus guarding the interests of both the people and capital investment, would it have then been necessary to create the Hydro-Electric Power Commission?

"In advising Mr. Flood and myself that under such circumstances you did not believe that the Hydro-Electric Power Commission would have been necessary, I would be very glad to have recorded with the answers an expression of your opinion in this regard.

"Reverting to my conversation with you on this point and the very clear explanation that you gave me as to why the Commission was formed, so that protection to the people might ensue in the absence of such control, it seems to both Mr. Flood and myself a most reasonable and an expected view that you would entertain.

"I was sincerely glad to hear that Sir Adam had passed the list of questions to you, and I indeed trust that by next Tuesday a sufficient amount of time will have passed to round up the answers, and that you and Sir Adam and I may have the pleasure of sitting down for an evening chat on the situation. As explained to you, and as you understand, I am more than anxious that whatever I may write on this situation may be clearly understood, may be backed by facts, and when read will leave the impression that there has been no room for prejudice or misunderstanding.

"Finally, the phase of the subject which I am now dealing with is so apart from the engineering and construction features, that I have hitherto considered, that I am sure both you and Sir Adam will understand that a better conception of the whole situation, especially with the questions answered, can be obtained by a discussion of the prime principles involved.

"Sincerely yours,
"(Sd.) W. S. MURRAY."

COPY

Letterhead of
HYDRO-ELECTRIC POWER COMMISSION
OF ONTARIO
ENGINEERING DEPARTMENT

"December 14, 1921.

"MR. W. S. MURRAY,

"Murray & Flood,

"Grand Central Terminal,

"New York, N. Y.

"MY DEAR MR. MURRAY:

"In answer to your several communications of recent date, I am attaching hereto a revised copy of the answers to your questions and a statement made by Sir Adam Beck with reference to the Queenston-Chippawa Development. I trust these will fully answer your questions in connection with this matter, and regret that there has been considerable delay in submitting to you the final answers to your queries. This has, however, been largely due to the very rapidly changing conditions in connection with the demands of the municipalities, and it is only recently that we have been able to determine with any degree of exactitude the load conditions that will obtain on the Niagara System.

"As you will note from the attached memoranda, the demand of the municipalities and the Commis-

sion's customers has been increased during the last year from 60,000 hp. to 70,000 hp., notwithstanding the fact that the country has experienced a considerable industrial depression.

"Yours very truly,

"(Signed) F. A. GABY."

December 14, 1921.

The Following are Sir Adam Beck's Answers to Questions Nos. 31, 37 and 38

"The estimates for the construction of the Queenston-Chippawa Development were first prepared in 1913-1914, and were submitted to the Government in September, 1915.

"For a 100,000 hp. installation and 180,000 hp. capacity Canal, or 6500 cubic feet per second Canal, the estimates were approximately \$10,500,000 without intake works.

"Adjusting this estimate for the rates of pay and the costs of material obtaining during the period of the construction of the Queenston-Chippawa Development, from 1918 to 1921, the estimates for the above work would have been approximately \$28,000,000, including an amount for intake.

"In 1916 an estimate was prepared for a 10,000 cubic foot per second Canal of 300,000 hp. capacity; that is, \$20,761,135. This estimate would have been approximately \$49,000,000 for rates of pay and costs of materials obtaining during the period of construction of the Queenston-Chippawa Development from 1916 to 1921.

"On account of the very great increase in the demand for power by 1918, the Commission authorized the increasing of the Canal to 15,000 cubic feet per second, and since that date improvements and refinements have been made, such as the lining of the Canal with concrete, which have resulted in obtaining a Canal of approximately 18,000 cubic feet per second under normal conditions of pool level, or a capacity of 550,000 hp.

"The Commission has not estimated the cost of completing the 550,000 hp., but has estimated the cost of the completion of the 275,000 hp. installation with a 550,000 hp. Canal and headworks, which estimate is in the neighborhood of \$60,000,000, the exact figures depending on the salvage value of the construction plant, which is a large item of cost in the above mentioned \$60,000,000.

"The Commission estimates that the load, with a return to normal industrial activity, will reach the capacity of the first installation of 275,000 hp. in 1923, and that at least 200,000 hp. will be the available load in the year 1922.

"The attached statement gives more detailed information as to this estimate with regard to future loads, and has been determined to be very conservative."

"November 25, 1921.

"Queenston-Chippawa Development

"The following is a brief outline of the extraordinary development and increase in the power loads in the Niagara District, and covers the efforts of

the Commission in the obtaining of additional supplies of power to meet the demands:

"Power first delivered—29th September, 1910.

"In 1911—23 municipalities were taking
4,200 hp.

"In 1912—33 municipalities were taking
19,000 hp.

"In 1913—48 municipalities were taking
36,000 hp.

"In 1921—151 municipalities were taking
331,000 hp. to
341,000 hp., including all contracts.

"In 1913 the Commission prepared and submitted to the Government a report, asking authority to investigate the development of power at Niagara. The Commission also prepared estimates to show that in a very few years they would utilize the total contract of 100,000 hp. from the Ontario Power Company.

"During the session of 1914 the Government authorized the sum of \$35,000.00 for investigation purposes.

"September 13, 1915, the Commission reported to the Government and recommended that legislation be enacted permitting the Commission to generate power at Niagara Falls and in accordance with this recommendation the Niagara Development Act of 1916 was passed. This was further amended in 1917 whereby full authority was given the Commission to proceed with this work.

"By 1915 the demand for power had reached the full amount of the contract with the Ontario Power Company of 100,000 hp. The estimates of the Commission were that by 1919 the municipalities would require 200,000 hp., and in view of the enormous increase in the demand for power the Commission entered into a further contract with the Canadian Niagara Power Company in May of 1916 for the supply of 50,000 hp. additional, all of which was used by the municipalities by January, 1917.

"In January, 1917, tenders for construction work were called for, and four or five large contracting firms on the Welland Canal, in Halifax, and in the Montreal District, submitted tenders on a 'cost plus basis' plus rental charge for ordinary steam-driven plant.

"At the same time the Commission's engineers submitted plans and estimates for entirely new design electrically driven equipment, which would eliminate the use of over one million tons of coal and require about one-third the number of men for its operation, and also greatly reduce the time for the completion of the work.

"The general plan of this scheme is to divert water from the Niagara River above the Falls at Chippawa, carrying the same in a canal approximately twelve and three-quarter miles and discharging same through the largest turbines ever built, at the power house located near Queenston.

"Preliminary work and engineering commenced on the Canal in May, 1917, and the actual excavation with shovels in March, 1918, and it is expected the Canal will be completed in December of 1921.

"Subsequent to the United States entering the War a conference was held with the American and Canadian Power Controllers, with a view of speeding up the work as a war measure and completing the development at the earliest possible moment for the manufacture of explosives, at which time it being anticipated there would be from four to five years of war. The Armistice coming in 1918 ended negotiations for this purpose.

"The original estimates provided for a 6500 cubic foot per second Canal.

"In view of the extraordinary demand for power in 1917-18 the Commission decided to increase the capacity of the Canal to 10,000 second feet, which in 1919 was further increased to 15,000 second feet, due to the ever-increasing demand of the municipalities for more power, and with further improvements adopted by the Commission the capacity will be further increased up to 18,000 second feet.

"The Commission ordered equipment in the Spring of 1918 and two of the five units are practically installed or 110,000 hp., and will be ready for operation in December of this year and January, 1922.

"Additional units will be installed until the complete installation of five units of 55,000 hp. each by December, 1922.

"The maximum capacity of the Canal will be from 550,000 to 600,000 hp., and the maximum installation in the generating station will be five units of 55,000 hp. each and five units of 75,000 hp. each, or a total of 650,000 hp.

"It is expected that by December 31, 1921, power will be generated and delivered for commercial use in the Queenston-Chippawa plant.

"It is anticipated that by the Fall of 1922 there will be a load of at least 200,000 hp. for the Queenston-Chippawa plant, operating the Electrical Development Company and the Ontario Power Company's plants at their maximum authorized loads, viz., 125,000 and 180,000 hp.

"I am attaching hereto a memorandum covering general description and statistics re the Queenston-Chippawa Development, and giving information as to its length and physical characteristics of equipment, and showing the work that will have to be done in connection with the excavation of the Canal and the construction of the power houses; also showing one year's progress during the year 1920-21, together with statement showing the adverse factors under which the Commission had to operate during the year 1921.

"It is expected that most of the work will be discontinued during the coming winter.

"The work to be done next year will comprise the completion of the highway bridges and the excavation of the earth and river section of the Canal.

"Upon the completion of the first installation of the five units for 275,000 hp. by December 31, 1922, the source of supply to the municipalities will be increased from two to four generating plants; the transmission lines will be increased from four to eight circuits, with six to Toronto, and upon the

completion of the Queenston-Chippawa Development the ultimate capacity of the four plants at Niagara will exceed 1,000,000 hp.

"The actual demands of the municipalities in 1920 amounted to 260,000 hp., and in 1921 to 316,000 hp. This may be increased by from 15,000 hp. to 25,000 hp., due to shortage on contracts, or a total maximum of 331,000 hp. to 340,000 hp. taken by municipalities and shortage on contracts, giving an increase over the 1920 demands and contracts of 60,000 to 70,000 hp.

"The Commission has temporary contracts for 91,000 hp. in addition to the 50,000 hp. from the Canadian Niagara Power Company, which may be canceled before February 1, 1920, as follows:

"Canadian Niagara Power Co.....	40,000	hp.
"Electrical Development Co.....	30,000	"
"Electro Metals	11,000	"
"Niagara, Lockport & Ontario Power Co.....	10,000	"
Total	91,000	hp.

"The shortage of contracts on the Ontario Power Company amounts to 25,000 hp.—shortage to municipalities 55,000 hp.—total 80,000 hp., together with above lapsing contracts, equal 171,000 hp.

Estimated increase in loads of 1922, 25,000 hp., or a total of approximately 200,000 hp., to which may be added the amount of 16,000 hp. excess of the Ontario Power Company, making a total of 212,000 hp., under normal industrial conditions, for the Queenston-Chippawa Development.

General Description and Statistics

"Preliminary work on Canal was started in May, 1917, active excavation with large shovels in March, 1918, Canal completed in December, 1921. At one time 8,100 men were employed on the construction work.

"The purpose of the Chippawa Canal is to convey water from the upper Niagara River to Queenston for the development of power at maximum efficiency with the use of the minimum quantity of water. This development has been rendered necessary by the ever-increasing demands for power in Ontario.

"The Chippawa development is the largest single power development in the world. The amount of material excavated from the canal proper is over 15,000,000 cubic yards of earth and rock.

"Total earth excavation....	13,200,000	cubic yards
" rock	4,182,000	" "
" concrete	450,000	" "
" length of canal....	12½	miles
"Maximum depth of canal cut	145	feet
"Maximum depth of rock cut	85	"
"Maximum depth of earth cut	80	"
"Available gross head.....	315	"

"Width of concrete section of canal.....	48	"
"Depth of water.....	35-40	"
"Maximum capacity of each turbine	60,000	hp.
"Total weight of each com- plete generating unit...	1,853,000	lbs.
"Total revolving weight of each unit.....	706,000	"
"Capacity per foot length of power house.....	900	hp.
"Ultimate length of power house	600	feet
"Height of power house above foundations.....	194	"

"If the power house building could be lifted bodily and placed in front of the American Falls, the view of the same would be entirely obliterated.

"The possible carrying capacity of the canal will be equivalent to a river having about 10 times the normal flow of the Trent River below Rice Lake, about 90 times the normal summer flow of the Grand River at Brantford, and about the same flow as the average regulated discharge of the Ottawa River at Ottawa, three times the normal flow of Nipigon.

"Eighty-two miles of railroad track was installed to handle excavated material. The trains are operated by 50 locomotives, the majority of which are electrically driven. Fourteen shovels were used to complete the excavation, most of which are electrically operated. Five of these shovels are larger than any heretofore built, and each one will load a 10-yard car, standing 60 feet above the shovel, in 1½ minutes. They would excavate a cellar for an average house in 4 minutes.

"During the construction of the canal, which crosses many of the main trunk railways through the Niagara frontier, the excavation was made and bridges were built without any delay to traffic.

"The power house below the cliff above Queenston is now completed for 2 main units, and is being extended until 9 units are installed. The first five units have a capacity of 55,000 hp. each and are the largest hydraulic operated units in the world. Ultimately a further five 75,000 hp. units will be installed. They use little more than half as much water per hp. as the other plants operating at Niagara Falls owing to the increased head obtained by the construction of the Canal. All the latest devices for obtaining maximum efficiency and for controlling the machines, and for maintaining continuity of service are being installed.

One Year's Progress

"One year ago today—

"(1) There remained 3,710,000 cubic yards of earth to be removed from the Canal.

"(2) There remained also to be removed 2,410,000 cubic yards of solid rock.

"(3) Only 7,000 feet of the rock cut was completed to a maximum depth of 60 feet.

"(4) Not a yard of concrete had been placed in the Canal lining walls.

"(5) Less than 5,000 cubic yards of concrete was in place on the whole work.

"Today:

"(1) All earth excavation is completed, the earth work in the Canal proper having been finished last August. The dredge "Cyclone" took out 1,160,000 cubic yards of this earth in 5½ months, being an average rate of more than 200,000 cubic yards per month. The Harbour Commission engineers rated the dredge at 100,000 cubic yards per month on this work.

"(2) The last yard of rock will have been removed from the Canal in 3 more working days.

"(3) Seven and a half miles of rock cut has been completed to a maximum depth of 85 feet.

"(4) Six and a half miles of concrete lining wall and bottom paving has been placed, and the lining will be completed in 15 more working days.

"(5) There is now in place 360,000 cubic yards of concrete, the same having been placed at an average rate of more than 30,000 cubic yards per month. Last June 62,000 cubic yards of concrete was poured in 25 working days.

"One year ago today the power house building was practically untouched, as the first batch of concrete was poured on November 8, 1920. Today this building contains 110,000 hp. of completely installed turbine and generator capacity, which will be in operation by the end of the present year.

"Since September 1, 1920, when it became necessary to speed up the work subsequent to the strike, there has been 7,650,000 cubic yards of earth and solid rock removed, or about 11,000,000 tons of material lifted an average height of 60 feet.

"The total amount of material excavated from the canal would load a train 4,750 miles long. Such a train would extend from Halifax to Vancouver and back again as far as Winnipeg. More than half of this train was loaded during the last 14 months.

"Points of Interest:

"(1) View from Convent Road Bridge.

"(2) Steam and Electric Shovels in operation.

"(3) Concrete lining plants in operation.

"(4) Trip down bottom of canal from Lundy's Lane to Forebay.

"(5) View of Forebay and Gatehouse.

"(6) View of Crusher Plant and Stock-piles.

"(7) View of Power House from top of Cliff.

"(8) View of Power House from below the Cliff.

"(9) Power House interior, including turbines and generators.

ADVERSE FACTORS

"Under this heading the outstanding condition from the standpoint of production and costs was the result obtained from the operations of the two large steam shovels placed in operation a year ago.

"When these shovels were ordered it was confidently expected that their greater operating speed would enable them to overcome and probably exceed, by increased production, the records of the electric

shovels already in operation on the work. They completely failed to establish such a record, either in the matter of actual yardage of production or in production costs. These shovels not only gave rise to serious delay in connection with their own schedule but caused a still more serious delay due to the obstruction to the operations of more efficient and economical plant. This obstruction not only applied to other shovels but to all classes of plant involved in the regular cycle of operations, covering such work as drilling, channeling, blasting, and train operation.

"The lining of the Canal involved structural features of an unprecedented nature, and the equipment originally supplied by the manufacturers for this work proved to be seriously lacking in strength and adaptability, and it was finally necessary to utilize a type of plant largely redesigned and remodelled by the Commission's own engineers. The failure of the originally purchased equipment to operate, together with the delay and obstruction caused by the steam shovels, resulted in a loss of nearly three months' time, which had to be made up by intensifying the concrete schedule and by the construction of a number of extra concrete lining plants.

"Another adverse factor entering into the work during the past year was the unprecedented increase in the cost of cement over the previous year.

"Labor turn-over is one of the most serious adverse factors entering into production efficiency on construction work. On the Niagara work, as on every other construction project undertaken during the war, the labor turn-over was enormous; conditions improved somewhat in 1920, and it was anticipated that conditions would return to normal within a reasonable time. As a matter of fact, however, throughout the whole of the Fall of 1920, and the first half of the year 1921, the labor turn-over continued to be a serious factor as affecting the progress of the work.

"The construction programme at Niagara also suffered considerable delay through fires. These fires were all of a nature which seldom if ever occur on construction work, as they were all of electrical origin. The actual monetary loss sustained by reason of these fires was of secondary importance as compared with the unascertained losses arising out of the interruption of schedule, idle plant and disorganized and unproductive labor."

Answers by F. A. Gaby

This terminates the statement made by Sir Adam Beck, and the following answers have been prepared by Mr. F. A. Gaby, at the request of Mr. William S. Murray, in his letter of September 9, 1921.

"Oct. 21, 1921.

"Corrected Dec. 2, 1921.

1. Q. "What was the reason for the inauguration of the League of Municipalities and the Hydro Commission?"

A. "The Province of Ontario has no coal

and depends for its entire supply on importation from the United States, or on the transportation of coal from the far East and the far West of the Dominion of Canada.

"The Province of Ontario is essentially the manufacturing center for the whole of the Dominion of Canada, and as power is one of the most important factors in the manufacturing business, men in the Western part of the Province as early as 1900, when the possibilities of long distance transmission of electric power first began to be understood, saw the great possibilities in the generation of power at Niagara Falls and its transmission to their municipalities to operate factories and supply domestic and commercial lighting service, thereby supplanting to a large extent the necessity of importing coal from the United States for power purposes.

"With the completion of the first large power development on the Canadian side at Niagara Falls the dream of these business men in the Western part of the Province appeared to be more of a reality, and many public meetings were held to discuss the proposition of the municipalities in this district securing a supply of cheap power from Niagara Falls to supplement or replace the costly power generated by the numerous steam plants.

"The Municipalities, however, received no encouragement from the generating and transmitting companies who had acquired the rights at Niagara Falls, and they were not disposed to supply power at any great distance, or to several small municipalities adjacent to or near the Falls, and confined their operations to one or two cities having a large industrial market for power.

"The Companies did not endeavor to meet the wishes of the people, or make any effort to co-operate, explain or take the people into their confidence, the result being the formation of a co-operative body of municipalities who appealed to the Provincial Government in 1902 and 1903 for authority to enable a group of municipalities to investigate the possibilities of generating and transmitting power for their requirements on a cost basis.

"The Government passed the necessary legislation enabling one or more municipalities to appoint and finance their own Commission for such an investigation in the year 1903.

"Under this Act four well-known business men were appointed by the

municipalities to investigate and prepare a report on the generation and transmission of power and its cost to the municipalities. A copy of this report is attached hereto, entitled, "Official Report of the Ontario Power Commission, 1903," published in 1906, which gives in more particular the details of the legislation and the personnel of the Commission appointed to prepare the report; from this it will be noted that the municipalities were empowered by this legislation to form co-operative groups, appoint their own Commissions, finance, construct and operate, as municipalities only, their own undertaking without reference to the Government.

"The legislation was amended in the year 1906, which Act also provided that the municipalities should undertake the financing on their own behalf and the bonding by their own Commission. This was amended in 1907 whereby the Government financed and held a mortgage on the properties of the municipalities until paid off in thirty annual payments by the municipalities. It is under the latter Act that the Commission is now operating, with amendments since that time.

"In the year 1908 twelve municipalities voted favorably under the legislation of 1907 and were authorized to proceed, under the Commission appointed in 1906 by the Government, to construct and operate through the Commission and distribution of power. The Commission, although it had authority to generate its own power, considered the invested rights and called for tenders for a supply of power at Niagara Falls, and accepted the lowest tender, namely, that of the Ontario Power Company, and contracted for a total amount of 100,000 hp. for a period up to 1950.

"In this way a partnership of municipalities was formed.

"The Government appointed a Commission as Trustee for and on behalf of the municipalities constructing and operating, and being financed by the Government, who held a lien on the properties until the moneys were repaid by the municipalities. Each municipality, or partner, signed a contract with the Commission to take and pay for the power it required at cost—cost to include cost of power at the source of supply, interest charges, sinking fund, maintenance, operation, renewals, insurance and other charges applicable to a business of this character, the agreements providing for an annual adjustment of the capital and

cost of operation among the municipalities.

"Further details in connection with the history and success of the scheme are set out in a statement of Sir Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, before the Committee on Water Power, of the House of Representatives, Sixty-fifth Congress, Second Session, Washington, April 15, 1918, a copy of which is attached hereto.

"I am attaching also a copy of 'Genesis of the Power Movement' and a short typewritten general history of the Commission's operations.

2. Q. (a) "What are the Provincial Acts bearing upon Hydro and its relation to the Municipalities, Water Powers and Radials?"

(b) "Where can copies of such be obtained?"

A. (a) "All the legislation under which the Hydro-Electric Power Commission of Ontario functions is set out in the attached volume entitled 'The Power Commission Act and the Hydro-Electric Railway Act, revised to 1921.'

"The general powers of the Commission are briefly described on pages 8 to 15 of the special report of G. T. Clarkson, Esq., of 1918. The constitution of the Commission is referred to on page 7. The auditing of the Commission is provided for in the legislation (pages 8 to 10) of the Power Commission Act, 1914.

"In addition to the Power Commission Act the Commission operates under the Hydro-Electric Railway Acts, the Water Power Regulation Acts, the Central Ontario Act and the Niagara Development Acts, all of which are set forth in the above referred to volume.

(b) "We are enclosing herewith a copy of the legislation entitled 'The Hydro-Electric Power Commission Act and the Hydro-Electric Railway Act,' which included all the Acts referred to under (a)."

3. Q. (a) "What financial reports are made by the Commission?"

(b) "Do these include all municipal operation?"

(c) "Can these be obtained for from 1910 to 1920 inclusive?"

A. (a) "Financial reports are made annually by the Commission on operation and a balance sheet showing the liabilities and assets of the Commission prepared.

"This information is shown in a com-

prehensive way in the Commission's Annual Report, Vol. I and also Vol. II.

(b) "Vol. II of the Commission's Annual Report embodies the annual reports of the various municipalities, or Municipal Utilities, including full information on their financial operations, and a comprehensive combined operating statement and balance sheet covering the number of municipalities mentioned therein, for the purpose of information. The operating statement of the municipalities include the total operating costs of the Commission; that is, the Commission has neither surplus nor loss in its operations, all expenditures being included in the cost of power, and in the statement of the municipalities; also the reserve funds of the Commission are reflected in the balance sheets of the municipalities.

(c) "Copies of the Commission's Reports, 1910 to 1920 inclusive, are attached.

4. Q. "Do the municipalities issue separate Reports, and if so, are these obtainable?"

A. "The municipalities do issue separate reports, but the reports of the Commission and the Municipal-Electric Utilities are in accordance in all particulars with the ultimate statements and accounts of the municipalities.

"Municipal accounts are audited by an official appointed by the municipalities, as well as being audited by the Commission's staff of auditors, who see that proper distribution is made and that they conform to the standard accounting system of the Commission.

5. Q. "For the year 1919, or preferably 1920, would it be possible to obtain for each System owned or operated by Hydro, and for the Ontario Power Company, a statement showing the following?"

"Investments:

Ontario Power Company

Other Plants

Transmission System

Distributing System

"Debentures outstanding against these investments.

"Deductions from Revenue.

"Operating Costs—Subdivided into:

Administration

Maintenance

and other operations.

Ontario Power Company

Other Power Plants

Transmission System

Distribution System

Administration and General Expense.

"Other deductions:

Taxes on Real Estate

Renewal Funds

Contingent Funds

Sinking Funds

Interest on Debt

Debit or Credit to Municipalities.

- A. "Insofar as the information herewith refers to the Hydro-Electric Power Commission's properties, a complete answer will be found in Vol. I of the Hydro-Electric Power Commission's Annual Report for 1920, in which a full financial statement is included.

"As regards the information for the Ontario Power Company, I am handing you herewith balance sheets and operating statement of the Ontario Power Company from the year 1918 to date, viz., 1918, 1919 and 1920.

"With regard to the Central Ontario System, this is being operated as a whole by the Commission for and on behalf of the Province, and a financial statement of same is included in the financial statement of the Commission under the heading 'Central Ontario System.'

6. Q. (a) "What disposition is made of the Renewal Fund?
(b) "Is it reinvested in extensions or used to retire securities?
(c) "What does the total Renewal Fund for Commission operations total to date?
(d) "For municipalities?
(e) "Also same information as to Sinking Fund and Contingent Fund."

- A. (a) "Renewal Reserves as provided by the Hydro-Electric Power Commission and the Municipal Hydro-Electric Utilities are invested in plant extensions, and Dominion or Ontario securities as authorized by the legislation. See page 12 of the attached Power Commission Act.

(b) "These funds may be used also to retire securities.

"In the case of municipalities, any surplus funds may be used also in the retirement of their debentures, as set forth on page 55 of the Power Commission Act.

(c) & (d) "The total reserves of the Commission are shown in Vol. II of the Commission's Annual Report, the total for the municipalities being \$4,796,927.39, and for the Hydro-Electric Power Commission \$2,428,116.68, or a total of \$7,225,044.07.

"Sinking Fund:

(e) "The Power Commission Act, Section 15, provided that all sums received by the Hydro-Electric Power Commission of Ontario from Municipal Corporations and others be invested by the Commission in securities of the Province. As regards the relief given to municipalities in respect to the payment of these fixed charges, the authority for so doing is set out in Section 23 of the Power Commission Act.

"Contingent Fund:

"This is a fund provided for by the municipalities in the cost of their power, more in the nature of an Insurance Fund, to meet any unforeseen contingency which might arise in the operation of any of the Commission's systems. In providing what is considered to be sufficient to meet such expense, an arbitrary charge of 25 cents per hp. per year is levied against each municipality in their cost of power.

"The municipalities finance their undertakings in general by serial debentures upon which the Sinking Fund is paid during the life of the debenture."

7. Q. "What does the Commission consider to be a fair allowance for depreciation and obsolescence?"

- A. "The Hydro-Electric Power Commission reserves the following depreciation on the Commission's Systems. This largely depends upon the relative amounts of the different classes of equipment and plant entering into the total.

"Niagara System: 2½% on tangible capital with a 4% improvement on balance in reserve account.

"Eugenia System: 2¾% tangible capital with a 4% improvement on balance in reserve account.

"Lester County System: 4% on tangible capital with a 4% improvement on balance in reserve account.

"Muskoka System: 2½% on tangible capital with a 4% improvement on balance in reserve account.

"Severn System: 2¾% on tangible capital with a 4% improvement on balance in reserve account.

"Rideau System: 1.85% on tangible capital with a 4% improvement on balance in reserve account.

"St. Lawrence System: 3% on tangible capital with a 4% improvement on balance in reserve account.

"Wasdell's System: 2% on tangible capital with a 4% improvement on municipal estimates.

"*Toronto and Hamilton:* 3¼% on tangible capital with a 4% improvement on balance in reserve account.

"*Other Cities:* 3½% on tangible capital with a 4% improvement on balance in reserve account.

"*Towns and Villages:* 4% on tangible capital with a 4% improvement on balance in reserve account."

(See reference, page 135; schedule 29.)
(Clarkson Report, August, 1918.)

8. Q. "Why were sinking fund payments deferred for five years?"

"Do municipalities now have to complete fund in 25 years from start or in 30 years?"

A. "Sinking fund payments, which are repayments of capital, were deferred in the commencement of operation of the new systems in order that the undertaking might have a chance to build up its business before commencing to repay its capital.

"The undertaking has to set aside renewal funds as provided in the Act. In the case of municipal systems there is no deferring of the sinking fund, as the financing is usually done by serial debentures.

"Kindly refer to Section 23, of the Power Commission Act; that section relating to deferring of Sinking Fund Payments, as follows:

"Notwithstanding anything in the Power Commission Act contained, a Municipal Corporation which has entered into, or shall hereafter enter into, a contract with the Commission for a supply of power may be relieved by the Commission from payment of any sum on account of the sinking fund account for the first five years, during which payments are made to the Commission by the Corporation under such contract, and the amounts required from such Corporation on sinking fund account shall be payable during the then next ensuing thirty years, 7 Geo. V, c. 20, s. 13."

"This section of the Act has been applied to every municipality connected with any Hydro-Electric Power System undertaking. This is the authority under which the Hydro-Electric Power Commission of Ontario has acted in relieving all municipalities from the payment of sinking fund during the first five years of operation. It will be noted that the Act requires the full payment of sinking fund during the then next ensu-

ing thirty years to liquidate their debts in respect to development plants, transformer stations and transmission lines."

9. Q. "What check is made upon the Commission's financial expenditures?"

"Does the Provincial Auditor make an annual report on this, and are these available?"

A. "Under page 10 of the Power Commission Act, Section 6, the Act provides that the accounts of the Commission shall, upon the direction of the Lieutenant-Governor in Council, be from time to time, and at least once every year, audited either by the Auditor for Ontario, or by other auditor or auditors named in the direction of the Lieutenant-Governor in Council.

"The firm of Clarkson, Gordon and Dilworth has been appointed by the Government to carry on the auditing of the accounts of the Commission. They have been instructed by the Commission to prepare a running audit of the Commission's undertakings.

"The Provincial Auditor does not make a detailed audit of the Commission's books, as the Government has appointed an auditor for this purpose, but he does make an annual report to the Government on the expenditures made by the Commission, in accordance with the moneys voted by the Legislature."

10. Q. "Are the two Clarkson Reports available? The last Report (1919) we understand to be an abstract of the original Report. Can the original Report be seen?"

A. "A copy of the Clarkson Report, covering a period from the commencement of the Commission's activities to the end of the fiscal year 1917 is available. Subsequent years' reports are on hand, but were not printed for distribution; a copy of the first Report to the end of the fiscal year 1917 is attached hereto."

11. Q. "What work is undertaken by the Commission, which is not chargeable directly to its power undertakings, but is chargeable to the Province as a whole, as is the case with Public Service Commissions within the States?"

"What were the amounts as charged in 1918, 1919 and 1920?"

A. "See Clarkson's Report, pages 20 and 21, for information on expenditures chargeable to the Province up to the year 1917.

"The Hydro-Electric Power Commission of Ontario undertakes the fol-

lowing work which is chargeable to the Province as a whole:

"Estimates for the supply of power to non-operating municipalities.

"General hydrographic surveys, storage surveys, reports and investigations of power sites, stream flow, and special hydrographic investigations and reports not applicable to the systems operated by the Commission.

"Engineering investigations, surveys and reports under the Water Powers Regulation Act, 1916.

"Preliminary investigations, estimates, surveys, by-laws and reports under the Hydro-Electric Railway Act of 1914.

"Estimates, surveys and demonstrations in rural districts.

"The amounts chargeable directly to the Province are as follows:

"1918	\$160,353.32
"1919	202,537.49
"1920	226,551.00"

12. Q. "The Commission has from time to time issued Special Publications on particular phases of its work. Can these be obtained?"

A. "The following publications may be obtained from the Commission, namely:
General Reports of the Commission.
Coal Consumption.
Various Generating Stations in Canada and the United States.
Reports on Hydro-Electric Railways, by W. S. Murray.
Report on Hydro-Electric Railways, by Bion J. Arnold.
Hydro-Electric Power Commission, Niagara District (Monthly Bulletin).
Rules and Regulations for Hydro-Electric Railways.
Standard Interpretation of Rates.
Uniform System of Accounts for Electric Utilities.
Hydro-Electric Power in the Niagara District."

13. Q. "Physical data, by years, for 1910 to 1920, inclusive, as to the following should be obtained. Much of this may be in the Annual Reports:

(a) Output Ontario Power Company, kw-hr. net generated, Average hp. delivered.

(b) Output, other Plants in same units.

(b1) Power purchased from Canadian Niagara Company (kw-hr. and hp.)

(c) Kw-hr. sold by Municipalities and to Industrial Consumers.

(d) Average hp. demand of Municipalities and Consumers.

(e) Population served by each System.

(f) Number of Consumers upon System."

A. "(a) See attached Report.

(b) See attached Report.

(b1) The average power purchased from Canadian Niagara Company is as follows:

1916	6,350 hp.
1917	40,727 "
1918	44,980 "
1919	49,883 "
1920	57,500 "

(c) Annual Report, Volume II, 1919, Statement 'D.'

(d) Annual Report of the Commission's operations for 1918.

This can be found on pages 18, 20, 22, 34, 38, 42, 46, 50 and 54. For previous years can be obtained from the annual reports, and from Volume II of the 1920 Report, when ready for distribution.

(e) Annual Report, Volume II, 1919, Statement 'B.'

Summation of population shown with estimates for the missing items. These items were omitted because of no authentic figures, but as most of them are Police Villages an average of 500 may be taken without seriously affecting the result desired.

(f) Volume II, Annual Report, Statement 'B.' Municipal Account Section of all Hydro Annual Reports."

14. Q. "Can we get a map of the Province of Ontario showing the extent of the several Commission Systems and other interesting information?"

A. "Yes, this may be obtained, and twelve copies are attached hereto."

15. Q. "What has been the effect of Hydro in bringing industry into the Province? Have any studies been made of this, so definite figures may be presented?"

A. "We have no statistical data to show the increase in Industries in the Province, other than the increase in the amount of power used and the number of consumers supplied. This information is all set out, in detail, in Volume 2 of the Commission's Annual Report.

"We are attaching hereto a survey of the industries in Ontario during the war period, which will give you some information as to the total quantity of steam plants that are operating, and the amounts of horsepower in steam plants in use in this district, also a report

entitled 'Electric Generation and Distribution in Canada, 1918,' by Leo G. Denis, Commission of Conservation, Canada."

16. Q. "In inspecting the properties of privately operated utilities, does Hydro make any charge to them for such service?"

A. "We do not inspect the properties of public utilities or privately operated utilities; the only inspection that is made is that of generating plants under the Water Powers Regulation Act, for the purpose of checking the amount of water used, and the capacity of the plants."

17. Q. "What control does the Commission hold over issuance of Licenses for Water Powers to Private Companies? Does it function as does our Federal Power Commission?"

A. "The Commission holds no control over the issuances of licences for water power leases to private companies. The Commission is only called upon at the discretion of the Government for information and recommendations, and acts in an advisory capacity.

"Attached is copy of standard water power lease and license of the Government.

"The Provincial Government issues its licenses on Provincial waters, and the Federal Government for navigable waters."

✓ 18. Q. "What was the length of contract with the Ontario Power Company executed in 1908?"

A. "The following is an excerpt from the 1909 report, which fully answers this question:

" 'This agreement shall remain in force for ten years from the date of the expiration of the said ninety days' notice. The Commission may, at its option, continue this agreement for one, two or three further consecutive terms of ten years each, by giving notice in writing of its intention to continue this agreement for the second term of ten years, at least three years before the expiration of the first term of ten years, and if pursuant to such notice this agreement is continued, by giving notice of its intention to continue this agreement for the third period of ten years at least three years before the expiration of the second term of ten years, and if pursuant to such last mentioned notice this agreement is continued, by giving notice of its intention to continue this agreement for the fourth term of ten years,

at least three years before the expiration of the third term of ten years. This agreement shall not, in any event, extend beyond the First of April, 1950, the date at which the first term of years of an Agreement of the Company with the Commissioners of the Queen Victoria Niagara Falls Park, dated Eleventh April, 1906, will expire.' "

19. Q. "Under this contract, what was the maximum amount of power that could be obtained by Hydro? Was the balance sold to Niagara, Lockport and Ontario Power Company? How much export was allowed, and was this reduced at various times?"

A. "(a) The maximum amount of power that could be obtained under the contract referred to was 100,000 hp.

"(b) No; the balance was sold to private consumers in the Province of Ontario, and to the Niagara Lockport Company.

"(c) The export allowed under the present licenses amounts to 60,000 hp., or 45,000 kilowatts.

"The license has not been reduced, but the amount of power exported was reduced by agreement with the Niagara Lockport Company during the war to an amount of 50,000 hp."

✓ 20. Q. "What were the reasons for the purchase of the Ontario Power Company when an advantageous contract was in force?"

A. "The Ontario Power Company was purchased so that the Commission could obtain better control of the power supply, thus resulting in better and more dependable service to its customers and the municipalities, and was purchased on the basis of its operating conditions and revenue obtaining at the time of purchase, also to protect the municipalities in their future power supply."

✓ 21. Q. "Under its agreement with Park Commission, how much total diversion was permitted the Ontario Power Company?"

A. "I am enclosing you copies of the franchises and agreements with the Queen Victoria Niagara Falls Park Commissioners which will give you the information which you desire."

✓ 22. Q. "What was the original purchase price of the Ontario Power Company?

(a) Stock

(b) Indebtedness assumed."

A. "I am enclosing you a copy of the purchase agreement between the Com-

- mission and the Ontario Power Company, from which you will note that the outstanding stock of the Company was provided for by an issue of \$8,000,000 4% bonds, in addition to which the debenture debt was assumed, amounting to some \$14,000,000, the exact amount being stated in the body of the agreement."
23. Q. "What additions have been made since purchase, to plant capacity, and what has been addition to capital cost from such?"
- A. "Are these additions temporary, or will they form a part of the permanent plant?"
- A. "The Generating Plant during the period of the war was extended to include two additional units, with a total capacity of approximately 40,000 hp., a third pipe line being installed; and, the addition to Capital Account in respect to this construction amounted to approximately \$3,300,000.00.
- "At the same time this pipe line extension was made the pipe line was installed as a temporary extension, to be removed, if so desired, by the Park Commission, at the end of five years."
24. Q. "Is the Ontario Power Company still operated as a company, and how are its charges made to municipalities? How is power from Canadian Niagara Power Co. charged in?"
- A. "The Ontario Power Company, Ltd., Niagara Falls, is an incorporated company, and is still being operated by the Hydro-Electric Power Commission of Ontario as such. The municipalities are being charged in accordance with the terms of the original contract, and additional power is charged for at increased rates.
- "Power from the Canadian Niagara Power Company is charged to the municipalities at the rate of \$12.00 per hp. as per agreement between the Commission and the Company."
25. Q. "What were the reasons for the proposed purchase of the Electrical Development Company?"
- A. "To conserve and prevent economic loss, due to duplication of systems within the Niagara District, and the properties could be purchased with existing contracts on a self-supporting basis."
26. Q. "How much diversion was allowed this Company under its agreement with the Park Commission?"
- A. "I am enclosing herewith copy of the franchise of the Electrical Development Company, which includes copy of agreement with the Queen Victoria Niagara Falls Park Commission, from which you will note that the Company has the right to develop for commercial uses 125,000 hp."
27. Q. "Why were certain Legislative Acts made necessary to permit such purchase?"
- A. "Section 8, Sub-Section 'G,' of the Power Commission Act, sets out the powers of the Commission in connection with the purchase of Distribution Plants and Stock in any incorporated Company, carrying on the business of developing, supplying and transmitting electric power, or energy, and it has always been the policy of the Commission to have such purchases validated by the Legislature, making them legal and binding on both parties."
28. Q. "Were the Electrical Development Company utilizing their full plant capacity, or were they operating only at partial capacity?"
- A. "The Electrical Development Company, under their Agreement with the Queen Victoria Niagara Falls Park Commission, were allowed to develop a maximum of 125,000 hp.; the Company's plant, however, has a total installed capacity of 146,000 hp.
- "The Electrical Development had sufficient contracts to operate its plant at full capacity authorized by its agreement with the Park Commission."
29. Q. "What is the present status of the Electrical Development Company negotiations?"
- "Is the Commission operating this and the Toronto Niagara Company for its own account or for that of the original owners?"
- A. "The matter is still in the hands of the solicitors and progress is being made towards its completion.
- "The Toronto Power Company is operating as Trustee for and on behalf of the Commission and the Toronto Railway Company since December 1, 1920.
- "I am attaching hereto copies of the letters of the Railway Company, signed by Mr. Robert Fleming, General Manager, and letter to the City of Toronto, signed by Sir Adam Beck."
30. Q. "What is the nature of the agreement between the Hydro-Electric Power Commission and the Toronto Niagara Company?"

- A. "In general the agreement covers the purchase of stock as set forth in the above referred to letters."
31. Q. "When were the first estimates of the Chippawa Development prepared and presented? Could we obtain original estimates and subsequent ones made to date, with alterations in original plans?"
- A. "The answer to this question is being fully dealt with by Sir Adam Beck in a statement which he will submit in the near future, and copy of which will be forwarded to you and will give you full information with this matter."
32. Q. "What is the gross head for this development? Net head? What diversion will be required for first development of 275,000 hp., and of second, to 495,000 hp.? Is the Canal adequate for 495,000 hp. development?"
- No answer given by Mr. Gaby.
33. Q. "What diversion is allowed the Canadian Niagara Company under their license? The total allowable diversion on the Canadian side being 36,000 second feet after deducting the allowed diversions to Canadian Niagara Company, Electrical Development Company and the Ontario Power Company, how much remains for Chippawa? Does the Dominion Power and Transmission Company diversion from Welland River have to be deducted? How much is this?"
- A. "The diversion allowed the Canadian Niagara Power Company is an amount sufficient to generate 100,000 hp. in accordance with their agreement with the Queen Victoria Niagara Falls Park Commissioners.
- "The amount of diversion that is allowable to the various Companies operating at Niagara Falls, as far as can be determined, is set forth in the Order-in-Council, of which you have a copy.
- (c) "We are not in a position to advise you what the Dominion Power & Transmission Company are permitted to divert from the Welland River, as this is a development using surplus of canal waters with certain rights under a license with the Dominion Government."
34. Q. "Is it the plan to take all or part of the diversion now allocated to the Ontario Power Company for Chippawa, and if such were done what steps have been taken to write off the value of the Ontario Power Company plant to a fair value as a standby? What do you estimate such a fair value to be? What is
- the total of renewal plus sinking funds charged off against Ontario Power Company since 1917?"
- A. "No definite decision has been arrived at by the Commission as to the manner in which they will operate the Ontario Power Company or as to whether they will divert a part of the water now allocated to the Ontario Power Company. This will all depend upon the conditions obtained from the operation of the Queenston Chippawa Development plant, as per the statement of the Ontario Power Company you will note the amount that is being written off for depreciation and sinking fund.
- "(b) It is the intention to operate the Ontario Power Company for the present, and no fair estimate as a standby plant has been considered.
- "(c) The total amount of renewal, plus sinking fund, charged off against the Ontario Power Company since 1917 amounts to \$1,634,557."
35. Q. "Certain Engineering reports have been prepared by the Commission Engineers on the Chippawa Development. Can these be had? Can the report made by H. L. Cooper be viewed?"
- A. "The Engineering Reports referred to are open to your view."
36. Q. "What amounts of Provincial bonds have already been issued against the Chippawa Development?"
- A. "The Commission receives the funds required in connection with the Queenston Chippawa Development from the Provincial Government, and the sum so advanced to date is approximately \$56,000,000, including plant and materials in stock, of which a large proportion will be salvaged."
37. Q. "What is the Commission's last estimate to complete Chippawa to 275,000 hp. to 495,000 hp.?"
- A. "The questions referred to here will be dealt with in Sir Adam Beck's statement as above referred to."
38. Q. "It is presumed the Commission has prepared load growth estimates in order to determine about when Chippawa will be loaded to 275,000 hp. and to 495,000 hp. Could we have these estimates?"
- A. "This question will also be answered in statement now being prepared by Sir Adam Beck."
39. Q. "Does Chippawa operate under a license from Park Commission in same

manner as their Power Companies? What restrictions have been placed upon the project as to export of power?"

A. "The Queenston-Chippawa Development is constructed under special legislation of 1916, called 'The Niagara Power Development Act,' which will be found in volumes submitted to you.

"The export of power is subject to license of the Dominion Government."

40. Q. "Has export of Chippawa power to the States been considered? Under what terms as to price and length of contract?"

A. "Export to United States for short terms has been considered, but no arrangements or agreements have been made for this plan, to date."

41. Q. "It is presumed that estimates have been made as to the investments in transmission system that will be required to dispose of Chippawa power. What do these sums amount to? Can these estimates be had?"

A. "The average cost per hp. to transform and transmit power from the Queenston-Chippawa Development will be between \$50.00 and \$60.00.

"Yes, these estimates are available."

42. Q. "We understand the 1920 annual report stated that units of Chippawa were to be in operation in September, 1921, but that since that time work had been largely shut down. For what reason?"

A. "Owing to the failure of the construction plant to meet the expected output, the plant was purchased in the Fall of 1920 and as a result of the inefficiency of the rush night work the Commission decided to reorganize and complete the plant along the most economical lines, and in August removed the night shift. The work has not been shut down in any particular, but a reorganization has been made of the work, which has resulted in a 37% reduction in the unit cost, due to the elimination of the inefficient night service and the reduction in wages. The increased labor efficiency amounted to 26%."

43. Q. "What were operating and production costs for Ontario Power Company in first year subsequent to taking over by Commission (1918)?"

A. "See Company's Operating Report and Balance Sheet for fiscal year ending October 31, 1918, copy of which is attached hereto."

44. Q. "To whom would you suggest we go to obtain information as to the opera-

tions and costs for the Toronto Niagara Power Company and its subsidiaries? We would appreciate a letter of introduction to one of its principal officers."

A. "I would suggest that complete information on this question can be obtained from Mr. R. J. Flemmig, of the Toronto Niagara Power Company."

45. Q. "Where can we obtain the following information?"

"The estimated cost both for the distribution system and the Municipalities' share in the commission system which were placed before the people of the Municipalities at the time the vote was taken, the population, total number of ratepayers voting upon the project. What was the assessed valuation of taxable property at that time, and what was the tax rate?"

"For 1920 where can we get for any municipality, town or village, the following information:

Population; assessed valuation; outstanding debentures for electric work and other public work; tax rates?"

A. "I am attaching hereto a statement giving answer to questions referred to herein. A perusal of the Commission's reports, copies of which are going forward under separate cover, will answer many of the questions asked, and a reference to the booklet on Municipal Statistics, prepared by the Provincial Secretary's Department. The Bureau of Municipal Affairs will give some further information regarding population, assessed value, taxation, debenture debt and sinking funds, etc.

"Referring to the statement attached hereto in answer to this question, you can make a comparison between this and the 1920 figures, which are incorporated in the second volume of the Commission's 1920 Annual Report. The population is shown in the fourth Municipal Bulletin, a copy of which is attached hereto."

46. Q. "Does the Commission require the municipalities to deposit municipal debentures with them as collateral for the expenditures the Commission makes in their interest? Is the collateral on a dollar to dollar basis, or what degree of security is obtained?"

A. "No, in the power scheme the municipalities do not deposit any debentures, but enter into a contract under which the Commission has a lien on the property until same is paid for."

47. Q. "Where can we obtain a copy of the

report recently made by a special commission on the Hydro Radial project? What is the present status of the Hydro Radials?"

A. "The report referred to we understand is being prepared for printing at the present time, and will be available in the near future. A typewritten copy may be obtained from the Provincial Government."

48. Q. "We would like to discuss certain general phases of the matter with Premier Drury. Would you be good enough to give me a letter to the Premier?"

A. "This matter has been referred to Sir Adam Beck."

49. Q. "Do you not think it would be well for us to look into the situation at Montreal? I would appreciate letters to some people there whom in your opinion would give us the best facts."

A. "I understand this matter has been already dealt with by you on your visit to Montreal."

50. Q. "We understand that a new station, known as the Nipigon Generating Station, is being constructed to serve Port Arthur."

A. "A new Generating Station, known as the Nipigon Generating Station, has been constructed on the Nipigon River, approximately 60 miles from Port Arthur, to serve the municipalities of Fort William and Port Arthur, and two units of this Plant are now in operation supplying power to Port Arthur."

51. Q. "What was the maximum demand for Port Arthur in 1920?"

A. "The maximum demand for Port Arthur, December, 1920—
Hydro-Electric Power Commission load..... 6,950 hp.
Current River load..... 1,500 hp.
Total 8,450 hp."

52. Q. "What is the capacity of the new generating station?"

A. "The present capacity of 2 units is 12,500 hp. each total 25,000 hp. - 12,500 hp. *DOWN*
"Ultimate capacity of plant with 6 units installed—75,000 hp."

53. Q. "What was the original estimated cost of this plant with its lines?"

A. "The original estimated cost of the generating station, including step-up transformers to 110,000 volts for

30,000 hp. transmission line 63 miles in length, 110,000 volt step down transformer station in Port Arthur for 30,000 hp.—estimated cost on conditions obtaining during construction as submitted to Government—\$6,472,479.00."

54. Q. "What has been spent to date, and what is the estimated cost to complete?"

A. "Amount spent on the plant to October 31st, 1921—\$6,587,136.56, and all the work as provided for in the estimates was completed as of that date with the exception of stripping forms off a part of the concrete on the dam."

55. Q. "Estimated cost to complete plant?"

A. "It is estimated that we will complete the construction of the work as estimated upon, less than the estimates.

"The above figures include construction plant, temporary buildings, construction railways, tools, operators' cottages, fire protection, waterworks systems for small settlement, lighting systems, etc., a large part of which will be salvaged on completion of the job."

56. Q. "Will Port Arthur be the sole immediate market for this power?"

A. "The City of Fort William has already signed a contract with the Commission to take power from the Commission, arrangements for which will doubtless be consummated on the expiration of the Franchise of the Kaministiquia Power Company to distribute power in the municipality, and it is probable that power will be supplied to this Municipality before that date.

"Contracts for a large amount of power are being negotiated at this time. The Village of Nipigon has also signed a contract for power. A pulp mill signed a contract to take approximately 16,000 hp. at this point."

57. Q. "Why was the Commission contract with Kaministiquia Power Company discontinued?"

A. "The contract between the Commission and the Kaministiquia Power Company expired on December 20th, 1920, and this contract was discontinued as the Kaministiquia Power Company have not sufficient power available to supply requirements of the district. The municipalities notified the Commission not to extend the contract."

58. Q. "What disposition has been made of the Hydraulic plant of about 2,300 horsepower owned by the Municipality of Port Arthur?"

A. "The Current River Plant, which is owned by the City of Port Arthur, is still in operation in a small way, but will shortly have to be discontinued excepting for a standby plant on account of the failure of the dams due to age. The amount of money required for renewal of these large storage dams is prohibitive, and the Municipality have decided it would be much more economical to purchase power than to reconstruct the same."

59. Q. "Is it carried upon the books at original cost price, or has it been amortized to represent only value as a standing plant?"

A. "Yes, carried at first cost \$348,096.00 but in common with all municipal construction, the cost is being automatically amortized by the Sinking Fund on the debentures issued for its construction being charged to Revenue each year, so that there will eventually be no capital liability. The unpaid balance of construction cost is now approximately \$190,000.00."

60. Q. "At what value is it carried on the Municipality's books?"

A. "In July 1920, the Electric Department of Port Arthur cancelled just charges against the local Waterworks and Street Railway Departments, totalling \$114,461.14, which otherwise would have been available to apply on the balance of the funded debt."

Mr. Gaby's first statement of October 21st had appended thereto, in answer to question No. 45, tabulations showing the investments of the Hydro-Electric Power Commission in Transmission Systems, the debentures of the several municipalities for their own distribution systems and assessed valuation, taxes, and bonded debt of the several municipalities as published in "Municipal Statistics." These tabulations while not reproduced are on file.

On December 13th, the Honourable Mr. Peter Smith, Provincial Treasurer for Ontario was interviewed and his opinion requested with regard to the seven following questions relating to Hydro. His reply follows:

Letterhead of
DEPARTMENT OF THE TREASURER
OF ONTARIO
OFFICE OF THE MINISTER

"TORONTO, Dec. 27, 1921.

"William S. Murray, Esq.,
"Grand Central Terminal,
"New York City.

"Dear Sir:

"Referring to your letter of the 14th inst., and to the interview which you had with me regarding

the Hydro-Electric Power Commission, I now beg to enclose herewith a memorandum which gives the answers to the questions you left with me.

Regretting that owing to the pressure of work at this season of the year, I was unable to give this information to you at an earlier date, and wishing you the Compliments of the Season, I remain,

"Yours very truly,
(SD) "P. SMITH."

Answers to questions re Hydro-Electric Commission

1. Q. "Do the accounting methods used by the Hydro-Electric Power Commission, including the audit of Mr. Clarkson, provide in your opinion an adequate check upon the expenditures of the monies advanced by or guaranteed by the Province?"

A. "Yes.

2. Q. "Does the guaranteeing of bonds either of the Hydro-Electric Commission or of the bonds of private companies assumed by them without the action of the Legislature, remove from the people the right to vote money?"

A. "The Legislature has given the Lieutenant-Governor-in-Council unlimited authority to guarantee bonds in connection with the purchase of power companies and while it is not strictly correct to say that it is an interference with the exclusive right of the Legislature to vote money, the Hydro-Electric Act does give the Lieutenant-Governor-in-Council unlimited powers to pledge the credit of the Province."

3. Q. "The accounts of the Hydro-Electric Power Commission are kept for the fiscal year of the Province ending October 31st, and those of the municipalities for the fiscal year ending December 31st. Is it possible, in your opinion, to at any time determine the exact financial status of the electric utility system of the Province of Ontario as a whole even with the use of two different fiscal years for the two elements of the system?"

A. "Yes. There could not be any interlocking of accounts between the provincial system and municipal systems. Some discrepancy in the accounts might occur owing to a change in rates for light and power charged by the municipality during the months of November and December. This, however, would be corrected during the following cycle and could not amount to very much."

4. Q. "Would you be kind enough to give us an approximate estimate of the direct and indirect liabilities of the Province of Ontario for the fiscal year ending October 31st, 1921?"

A. "Direct Liabilities approximately October 31st, 1921, \$204,634,825.76.

"Indirect Liabilities approximately October 31st, 1921, \$35,660,299.57."

5. Q. "Under the sinking fund requirements as set forth in the Power Commission Act, is the Hydro-Electric Power Commission required to set up the same nature of sinking fund on its own bonds and on bonds of private companies assumed by the Commission in the purchase of such properties?"

A. "Sinking funds of underlying bonds covering the assets of any Company, shares of which have been purchased by the Commission, are provided yearly in accordance with the terms of the trust deeds securing such bonds. Sinking funds with respect to securities issued by the Commission in purchase of shares of such companies have not hitherto been provided for, but the matter having been brought to the attention of the Government with the purchase of certain outstanding shares of the Ontario Power Company, further consideration may be given to it."

6. Q. "Why does the Commission continue to operate the Ontario Power Company, the Central Ontario System, the Essex County System and the Thorold System as separate entities from the main systems? Is it possible by so doing to avoid certain requirements of the Power Commission Act with respect to sinking funds, renewals and other practices and to accordingly make a better financial showing for these Companies?"

A. "The Commission originally purchased only part of the shares of the Ontario Power Company and there were outstanding bonds. It is, therefore, necessary pending the acquiring of the balance of the shares and to paying off of the indebtedness of the Company to continue to operate it as a separate concern. The Central Ontario System belongs to the Government, the municipalities have no interest in it, it is, therefore, necessary to continue it as a separate entity. The Essex County System and the Thorold System are continued as separate entities because no municipality is responsible. They belong to the Commission. Where a system is purchased such as the con-

templated purchase of the MacKenzie interests in Toronto which are subject to a heavy bonded indebtedness unless the bondholders exchanged their bonds for Government bonds it would be necessary to continue such systems as a separate entity, until such time as the bonds should be paid off."

7. Q. "What is your opinion as to the advisability of the Commission giving its own bonds or bonds of the Province in the purchase of private companies for such intangible assets as water rights, franchises, good-will, contracts, etc., particularly when many of these intangible assets had value only because they were obtained from the Government."

A. "The Government having granted to a Company a franchise, the question is, should they deprive the Company of its franchise, water rights, good-will, and other intangible assets secured by reason of its franchise without paying any price, or should they pay a fair price for same? I do not care to suggest an answer to this question."

In an interview on December 13th, 1921, with Premier Drury, nine questions were laid before him and his opinion was sought in answer to these questions.

Following are the answers by Premier Drury contained in the letter from Mr. Horace Wallis, Deputy Minister, January 19th, 1922.

Letterhead of

OFFICE OF

THE PRIME MINISTER & PRESIDENT OF THE COUNCIL—ONTARIO

"TORONTO, January 19th, 1922.

"Mr. W. S. Murray,
"Care Murray & Flood,
"Grand Central Terminal,
"New York City.

"Dear Sir:—

"By instruction of the Prime Minister I send, herewith enclosed, answers to the questions submitted by you which Mr. Drury thinks, is as far as he is prepared to go at the present time.

"Trusting this may be of service, I am

"Very truly yours,

(Sd) "HORACE WALLIS,

"Deputy Minister."

1. Q. "In your Glencoe speech made last Autumn in which you discussed the Hydro-Radial situation, you stated that \$61,500,000 had been spent (or appropriated) by the Province for the Queenston-Chippawa development. Was this figure based upon official estimates

- of the Commission and have you since that time received further official estimates as to the time for completion and as to the final cost of the 275,000-horse-power development now being made?"
- A. "The figure was the total expenditure up to the beginning of the fiscal year 1920-21 and advances made since then as compiled from official sources."
2. Q. "It is reported to us that the Government is discussing the advisability of taking over the Chippawa-Queenston development and writing off a portion of its cost so that the rates to the municipalities taking power therefrom will not be increased. Will you please give us the facts with regard to this policy?"
- A. "I am not aware that this proposition has yet taken any definite shape."
3. Q. "In one of your speeches made about the middle of July, you stated that the \$7,000,000 had been spent (or appropriated) for the Nipigon Development. Was this figure based on official estimates given you by the Commission and have you since that date received official estimates as to the final cost for the Nipigon development?"
- A. "The statement you quote was an approximate estimate. Official estimates of the final cost have not been received since then."
4. Q. "We understand that delegations from both Port Arthur and Fort William have been sent to Toronto at different times, seeking relief from the high cost of power which will result from the Nipigon development. Is it true that the Government is considering taking over this development and writing off a portion of the cost so that rates comparable with those enjoyed in the past can be given to the people of Port Arthur and Fort William?"
- A. "The Government is not at present considering this question."
5. Q. "Mr. Clarkson informed us about November 15th that he had just completed his audit for the year ending October 31, 1920. Would it be possible for us to obtain a typewritten copy of this audit, or if not, to read Mr. Clarkson's report?"
- A. "As soon as Mr. Clarkson's report is available a copy will be sent to you."
6. Q. "What do you believe the effect of the widely varying costs for power to the several municipalities of the Province will result in? Will they concentrate industry at a few favorable locations with respect to power and to the disadvantage of the balance of the Province?"
- A. "It seems reasonable to assume that the places having the cheapest power will prove most attractive to industry, other things being equal."
7. Q. "Does the action of the Legislature in the last session in providing for the subsidising of "farm lines" destroy the principle of service at cost for that class of business?"
- A. "I do not consider that the special assistance given to rural transmission lines destroys the principle of service at cost, although it does modify the application of the principle to a certain extent."
8. Q. "The average cost per unit of energy must reflect the true cost of power to the people inasmuch as the cost of power used in industry is reflected in the price of every commodity manufactured. Assume for instance, that the average cost of energy for the cities of Montreal, Buffalo and Toronto were the same; i. e., that the cost for power to the people were the same. Then, if the rate for domestic lighting in Toronto is very low as is the case, the rates for industrial must be correspondingly greater.
- "What do you believe will be the ultimate outcome of such a policy in rate-making? Will it tend to withdraw industry from Ontario to Quebec or to the Niagara district of the United States by reason of lower rates for industrial power?"
- A. "In the long run, industry will go where production can be maintained at a minimum of cost."
9. Q. "Do you believe that governmentally-owned utilities should be relieved from paying taxes, or per contra, should they pay their own way, thus relieving the general tax-payer, whether a consumer of the utility or not, from making up the amount of taxes so lost through some other form of taxation?"
- A. "Our electrical development pays taxes on the land occupied, but not on the improvements. It is difficult to lay down a general rule which can be rigidly adhered to. Private enterprises are sometimes partially exempted from taxation where the people concerned so decide."

SECTION B—(Part II)

ORIGINATION AND GROWTH OF THE HYDRO-ELECTRIC POWER COMMIS- SION OF ONTARIO

The Origination of the Hydro Movement:

No coal resources are known to exist within the boundaries of the Province of Ontario, making it necessary where power is produced by steam electric plants to import coal from the States or from Nova Scotia. The distance from either of these coal fields is great and accordingly steam-produced power in the province is costly. On the other hand, the province is fortunate in having nearly 7,000,000 horsepower (developed and undeveloped) in water powers, besides being in the further advantageous position of having large amounts of these water powers located in fairly close proximity to its industrial centers.

The first large power developments at Niagara Falls were made on the American side of the river and these were followed shortly by the construction of the plant of the Canadian-Niagara Power Company, which was placed in operation in the early part of the present century.

The Hydro movement took its first concrete step with the appointment of a committee of the Toronto Board of Trade on the 25th of April 1900, which was specifically authorized to investigate the power needs of Toronto. The hopes of this committee were expressed by the following words taken from its report:

"Our hope for cheaper power is to bring the current from one of the great Niagara generating plants. The Toronto Electric Light Company have signified their intention of bringing power from Niagara Falls and the question arises whether or not Toronto, as a city, should control this proposed Niagara Power connection. . . ."

The Queen Victoria Niagara Falls Park Commission, which has jurisdiction over the use of waters from the Niagara River on the Canadian side, made an agreement with the Canadian-Niagara Power Company dated April 14, 1892, permitting that company to divert water for the production, sale and distribution of electrical and pneumatic power. This agreement entitled the Canadian-Niagara Power Company to divert water up to the capacity of the works to be approved by the Park Commission, and in return for this license the Canadian-Niagara Power Company agreed to pay certain fees, or rentals, for the use of the water, varying with the amount of power generated.

The second franchise granted was one to the Ontario Power Company, dated April 11, 1920, and the conditions of that grant were very similar to those of the Canadian-Niagara Power Company grant.

The third and last grant to a private power corporation was made to the Electrical Development Company, Limited, January 29, 1903. The direct

grant was made to Sir William Mackenzie, Sir Henry Pellatt and Mr. Frederic Nicholls, all of Toronto, who later transferred their interests to the Electrical Development Company, Limited. This last grant specifically limited the amount of power which the Electrical Development Company could generate to 125,000 commercial horsepower.

Following the action of the Toronto Board of Trade several meetings of the representatives of the different cities in the province were held in the early part of 1902, and at these meetings were present not only representatives of the cities themselves, but representatives from the Canadian Manufacturers Association and of the several Boards of Trade of the different municipalities. The manufacturers of the southwestern portion of the province felt that the water powers of Niagara Falls might be utilized to supply energy to places at considerable distance from the Falls themselves, and they were very anxious to obtain cheap water power to replace the expensive steam-produced power they were then using.

Mr. Gaby, in answer to the questions set forth in section "A," states—

"With the completion of the first large power development on the Canadian side at Niagara Falls, the dream of these business men in the western part of the province appeared to be more of a reality, and many public meetings were held to discuss the proposition of the municipalities in this district securing a supply of cheap power from Niagara Falls to supplement and replace the costly power generated by numerous steam plants.

"Municipalities, however, received no encouragement from the generating and transmission companies who had acquired the rights at Niagara Falls, and they were not disposed to supply power at any great distance to small municipalities, and to confine their operations to one or two cities having a large industrial market for power.

"The companies did not endeavor to meet the wishes of the people, or make any effort to co-operate, explain or take the people into their confidence, the result being the formation of a co-operative body of municipalities who applied to the provincial government in 1902 and 1903 for authority for a group of municipalities to investigate the possibility of generating and transmitting power for their requirements."

The statement above made by Mr. Gaby as to the lack of co-operation between the companies and the people is borne out from every source to which this investigation has led. Unquestionably the failure of these companies to recognize the interests of the people led to the action of the Government in 1903 in passing the necessary legislation to enable a group of municipalities to appoint and finance their own commission.

Report of the Ontario Power Commission

Under the legislation just referred to, seven municipalities; namely, Toronto, London, Brantford, Guelph, Stratford, Woodstock and Ingersoll; appointed a Commission to report on the power requirements in the district concerned, the capital and operating costs of the proposed works, and the rate that would have to be charged to the consumers of power and light in the establishment and operation of municipal power, heat and light works.

The Ontario Power Commission made its report to the seven municipalities on March 28, 1906. The commission had employed Mr. R. A. Fessenden, an electrical engineer of Washington, D. C., as the technical member of the Commission, and it had further employed the firm, Messrs. Ross and Holgate of Montreal as consulting engineers. The Commission in its conclusion recommended that the proposed enterprise be taken up and pushed to completion, and be carried out on a scale suited to the needs of as many municipalities as were willing to join in the undertaking, and, in the event of other municipalities being unwilling to take up the matter, that those directly represented on the Commission carry out with all possible expedition the development of 60,000 horsepower.

The findings of the Commission were based on the report of the consulting engineers. These engineers estimated that from the seven municipalities involved there was an average load of 73,630 horsepower, of which about 55,556 horsepower would be available as a power market to the municipal enterprise. It further investigated loads in eleven other municipalities, and reported that the net power required for the total of the eighteen municipalities would amount to 81,125 horsepower.

The consulting engineers investigated the cost of constructing at Niagara Falls, at four points of location, plants of a capacity of 30,000, 60,000 and 100,000 horsepower, and they came to the conclusion that a plant of 30,000 horsepower could be constructed for approximately \$2,400,000, or about \$80.00 per horsepower, and that a plant of 100,000 horsepower could be constructed for about \$4,626,000, or \$46.26 per horsepower.

They further recommended the construction of a transmission line between Niagara Falls and Toronto, and also a second line between Niagara Falls and London, and also estimated the cost for transformer stations and distribution stations for the seven municipalities directly represented on the Commission. The conclusion of the work of this Commission is best brought out in Table 25 of its report, in which the cost of power per horsepower per annum, delivered to the municipal sub-station switchboards, is given. For a 30,000 horsepower development at Niagara Falls the estimated cost ranged from a minimum of \$17.60 per horsepower year for Toronto to \$27.62 per horsepower year for Stratford, and for the development at Niagara Falls of 100,000 horsepower, they showed a material reduction in these costs, which then ranged

from \$12.06 per horsepower year at Toronto to \$15.99 per horsepower year at Stratford.

Following the report of this Commission, the Legislature of the Province of Ontario in 1906 passed an Act known as the "Power Commission Act," which appointed a body under the name of the Hydro Electric Power Commission of Ontario to continue the work of the old Ontario Power Commission. In 1907 the Power Commission Act was amended, and it was under the Act of 1907 that the real activities of the Hydro Electric Power Commission started. The Commission is still operating under this legislation, which has been amended from time to time and which is discussed in Section "C."

Original Agreement Between the Hydro-Electric Power Commission and Fourteen Municipalities

The first contract made between the Hydro Electric Power Commission and the municipalities in Ontario was dated May 4, 1908.

The Commission agreed by that contract to supply by May 19, 1910, a total of approximately 26,000 horsepower at a price varying from \$18.10 per horsepower year for Toronto to \$29.50 per horsepower year for St. Marys. Each municipal corporation under this contract agreed to take power exclusively from the Commission, and to pay for the power in the following manner:

"To pay annually, interest at 4% per annum upon its proportionate part of the monies expended by the Commission on capital account for the construction. . . ."

"To pay an annual sum for its proportionate part of the cost of the construction . . . subject to adjustment under paragraph 10, so as to form, in 30 years, a sinking fund for the retirement of the securities to be issued by the Province of Ontario."

"To bear its proportionate cost of the line loss and to pay the proportionate cost to operate, maintain, repair, renew and insure the said lines and works . . . subject to adjustment under paragraph 10."

"To pay for three-fourths of the power supplied and held in reserve at said date and upon said notification whether the said power is taken or not. . . . When the power factor of the greatest amount of power taken . . . falls below 90%, the corporation shall pay for 90% of the said power divided by the power factor."

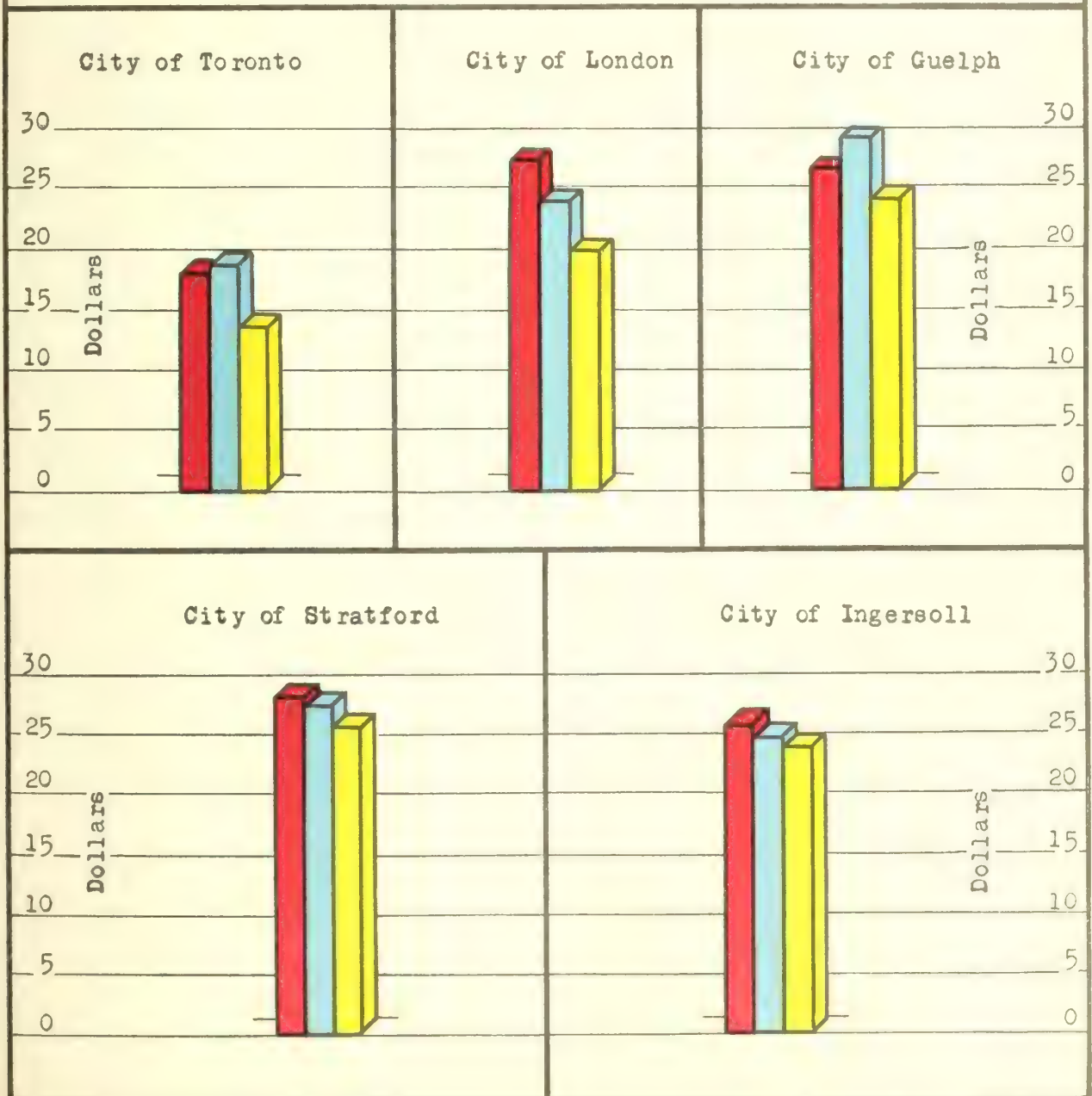
"The Commission shall at least annually adjust and apportion the amounts payable by municipal corporations for such power and such interest, sinking fund, line loss and cost of operating, maintaining, renewing, and insuring the lines or works."

"It is hereby declared that the Commission is to be a trustee of all property held by the Commission under this agreement for the Corporation, and other Municipal corpora-

Figure 1
Estimates with respect to the cost of power compared
to the actual costs paid for the Niagara
System, on a 30,000 H.P. basis.

Legend

- Estimated cost by the Ontario Power Commission
March 28, 1906 based on a sale of 30,000 H.P.
- Estimated maximum cost stated in schedule "C"
of contract between H.E.P.C. and municipalities.
(Date of first contract May 4, 1908)
- Actual wholesale rate paid by the Municipal
Commissions in 1913 when sales were
approximately 37,000 H.P.



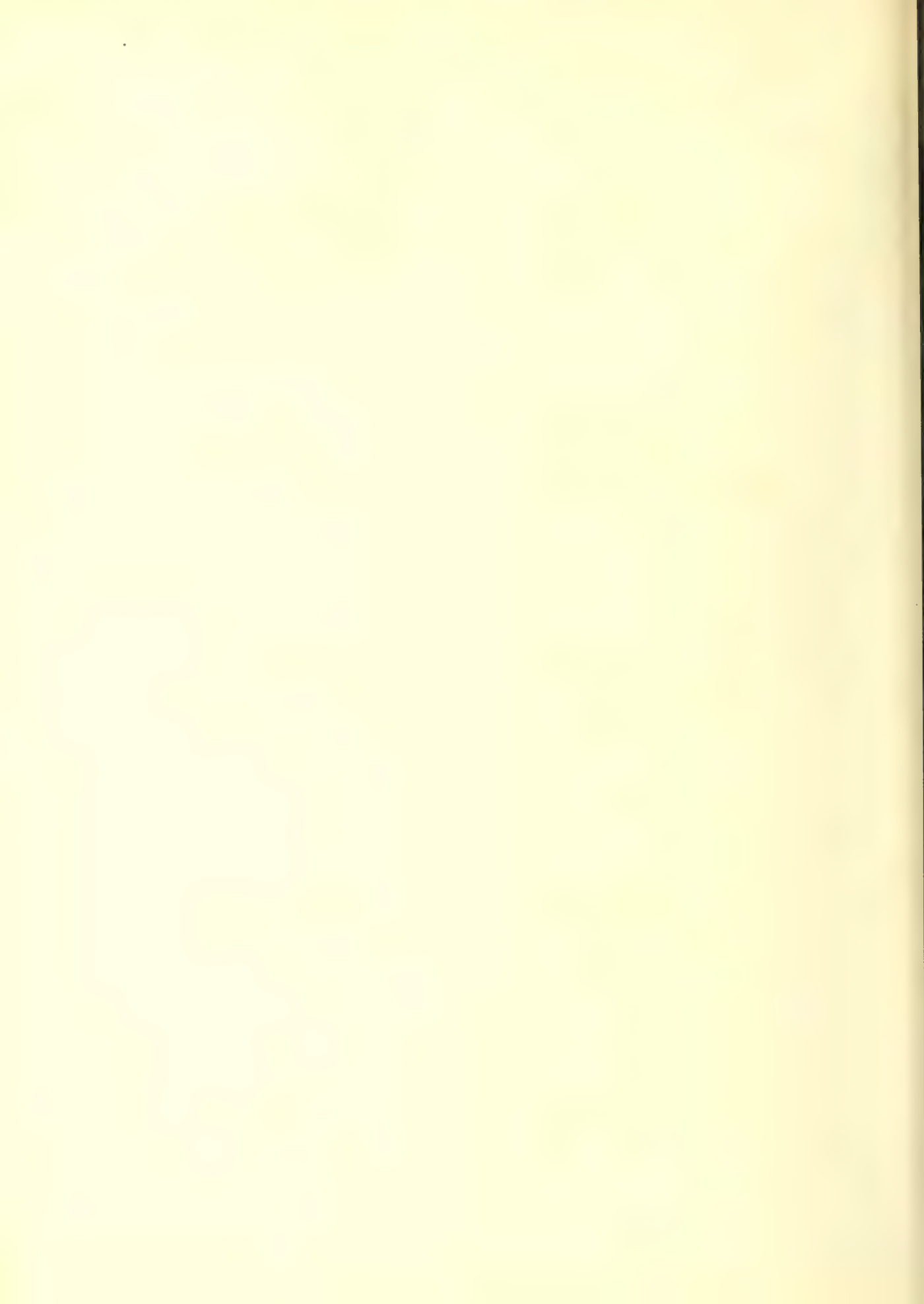
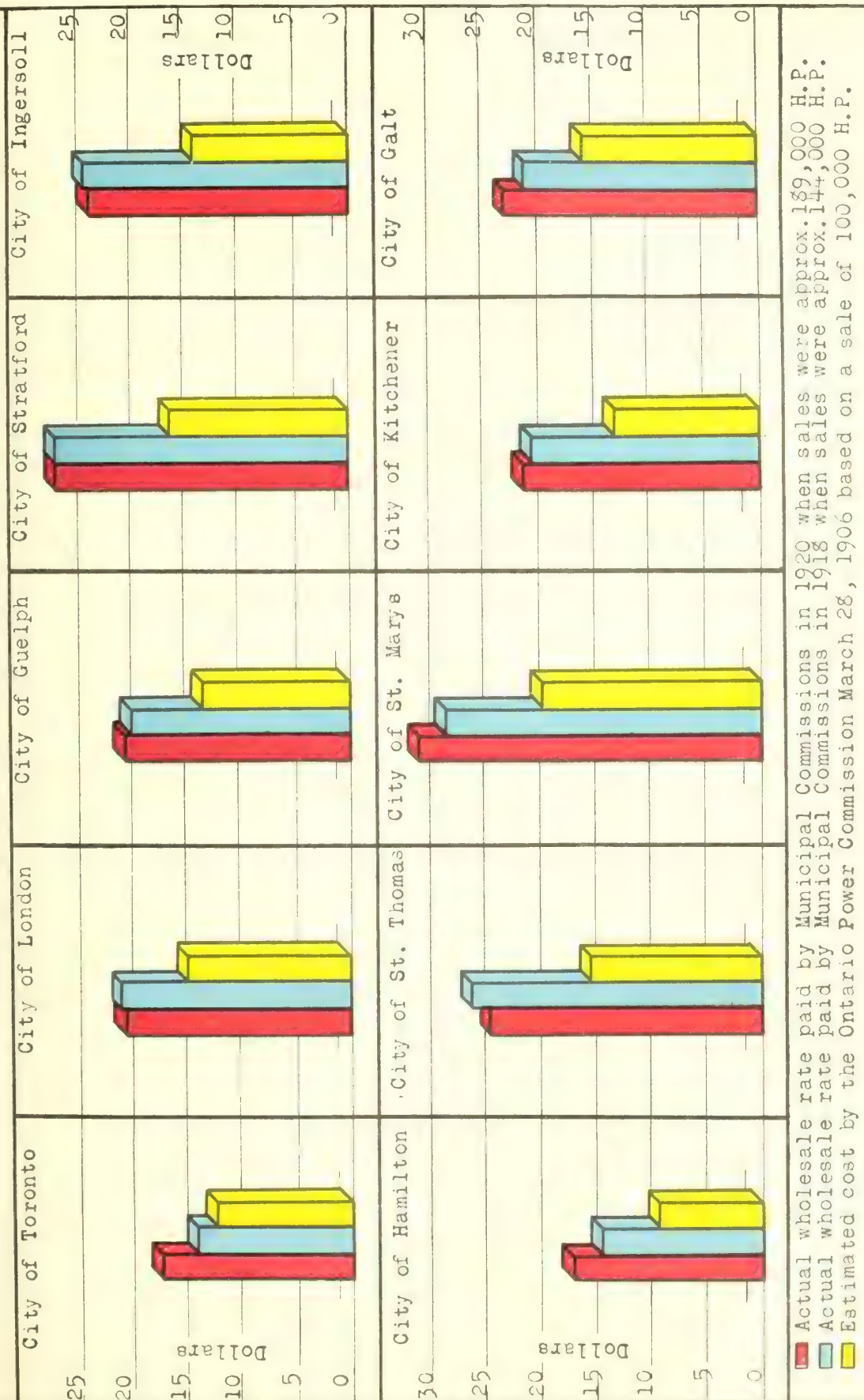
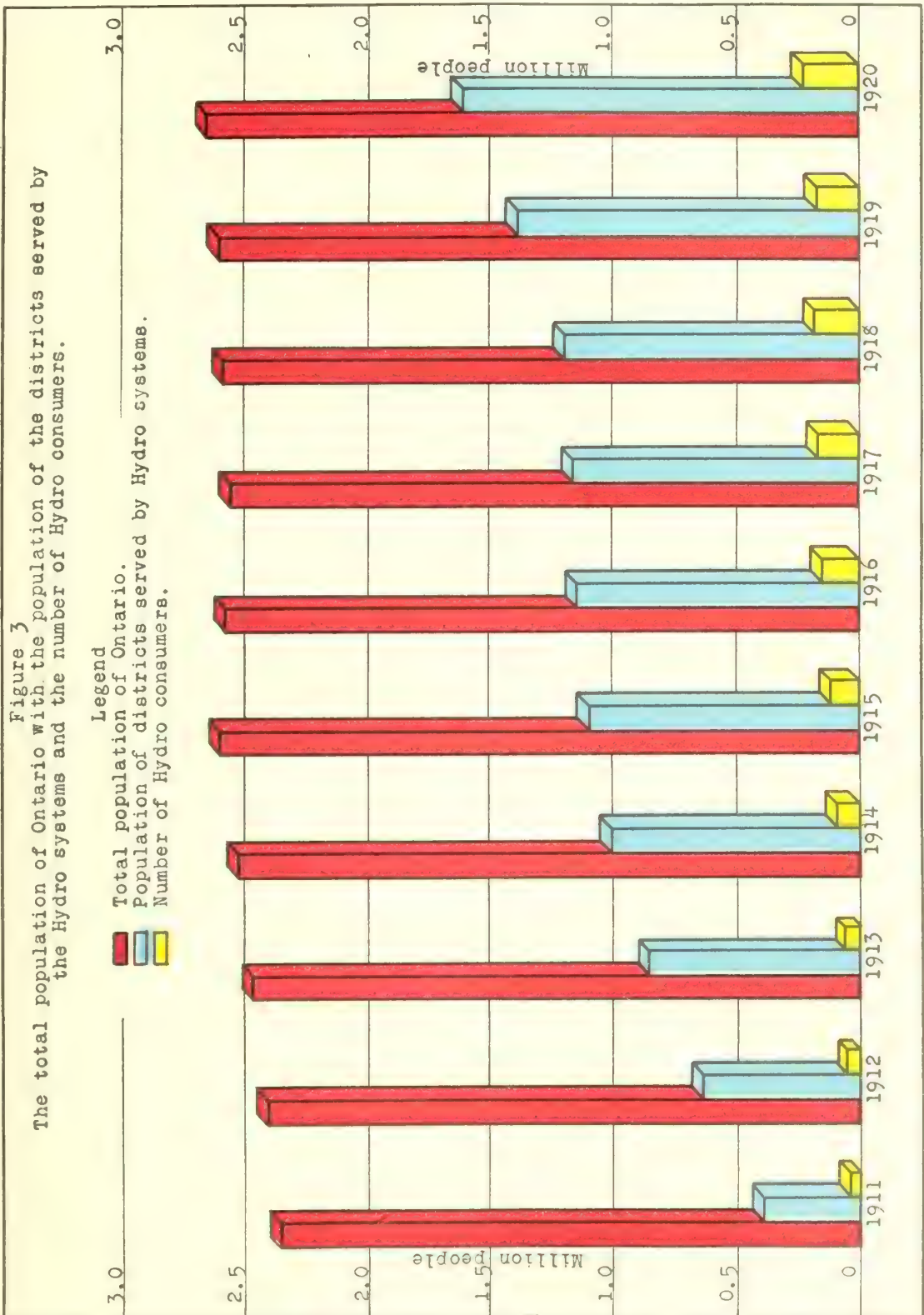


Figure 2
Estimates with respect to the cost of power compared
to the actual costs paid for the Niagara
System, on a 100,000 H.P. basis.



Actual wholesale rate paid by Municipal Commissions in 1920 when sales were approx. 189,000 H.P.:
 Actual wholesale rate paid by Municipal Commissions in 1918 when sales were approx. 144,000 H.P.:
 Estimated cost by the Ontario Power Commission March 28, 1906 based on a sale of 100,000 H.P.



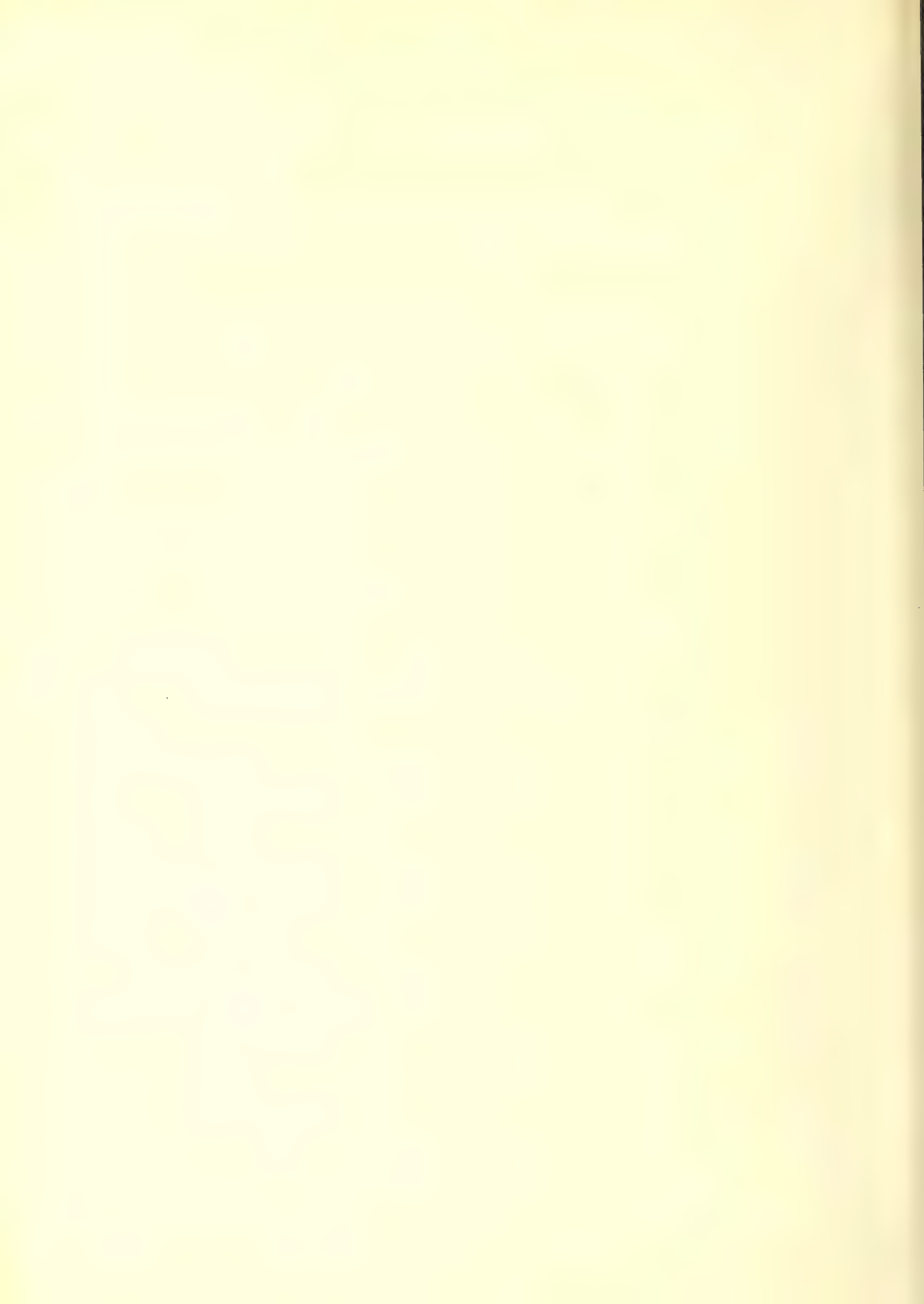


Figure 4

The service performed by Hydro for the people of Ontario.

Legend.

- The ratio of the population in the districts served by the Hydro systems to the total population of Ontario.
- The ratio of Hydro consumers to the total population served by the Hydro systems.
- The ratio of Hydro consumers to the total population of Ontario.

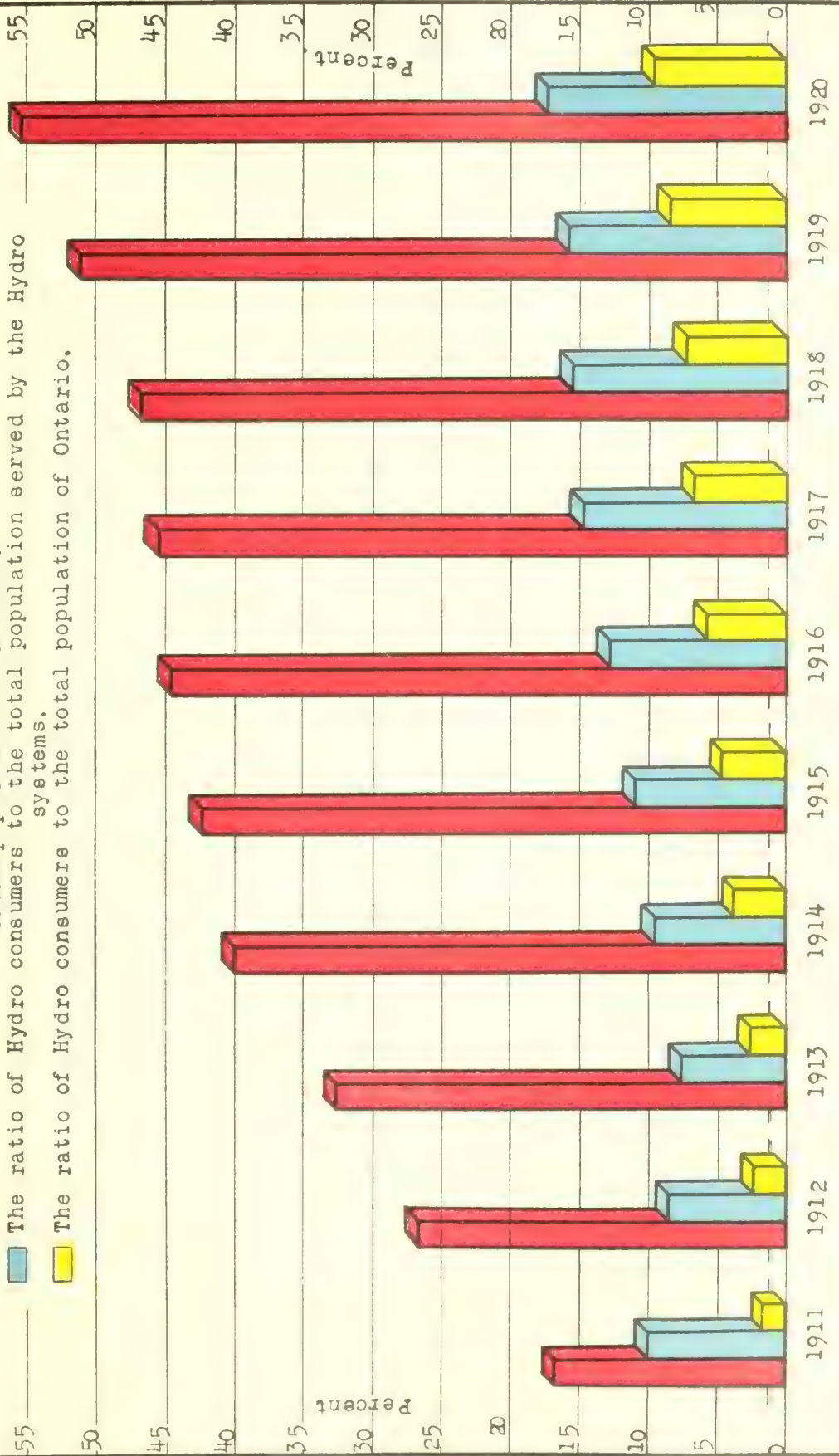
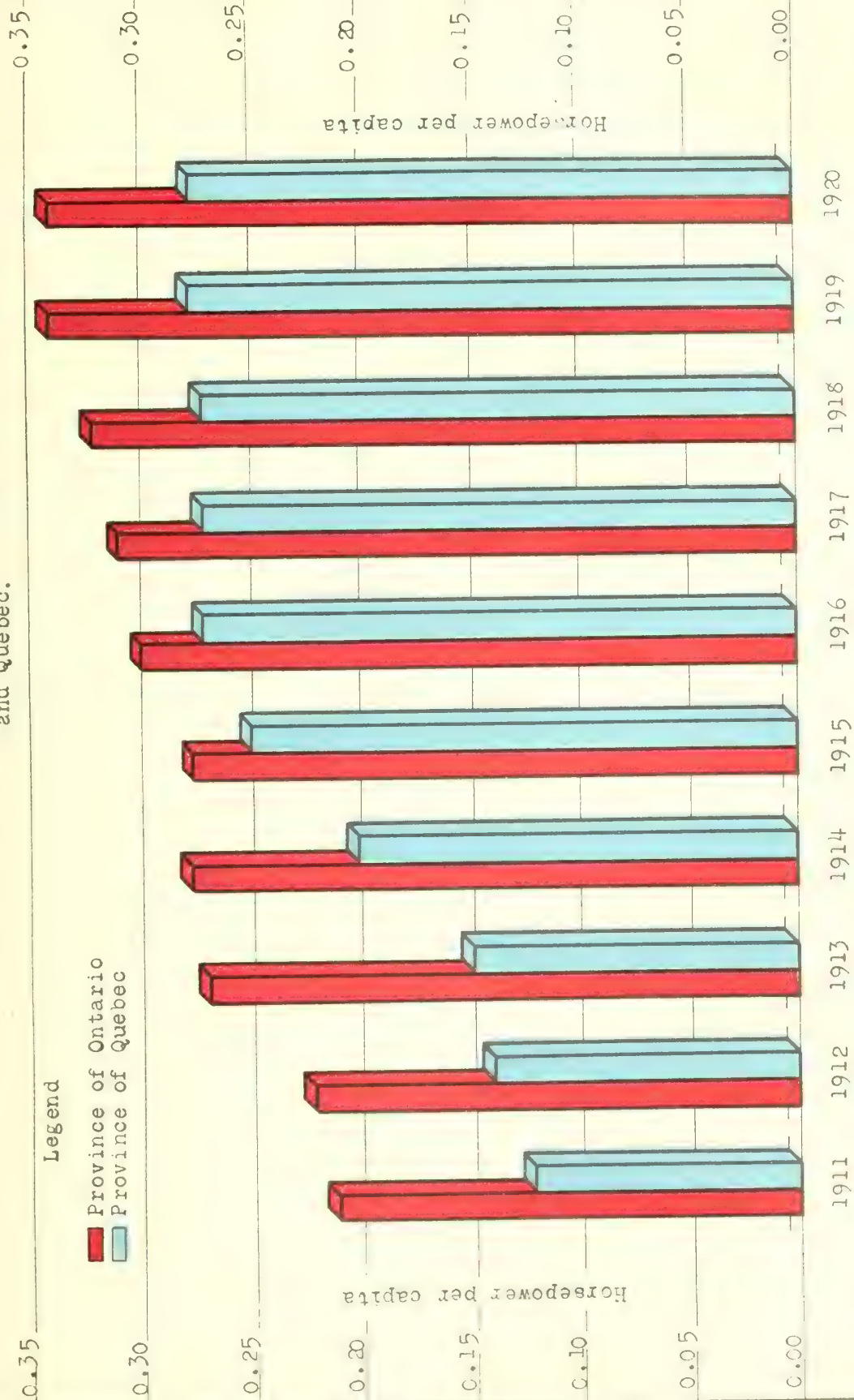




Figure 5
The growth of water power development per capita in the provinces of Ontario and Quebec.



tions supplied by the Commission, but the Commission shall be entitled to a lien upon said property for all monies expended by the Commission under this agreement and not repaid. . . ."

This original contract between the Power Commission and the municipalities was signed by fourteen municipalities, and the construction required to furnish them with power was the start of the physical structure owned and controlled by the Hydro Electric Power Commission on behalf of the municipalities.

The Contract Between the Hydro-Electric Power Commission and the Ontario Power Company

The Ontario Power Commission, in its report of 1906, recommended the construction of at least a 60,000 horsepower plant at Niagara Falls, and it estimated that power could be delivered at the switchboard of such a plant for \$8.39 per horsepower per annum for a 30,000 horsepower plant; \$5.89 per horsepower per annum for a 60,000 horsepower plant, and \$4.95 per horsepower per annum for a 100,000 horsepower plant.

The Hydro Electric Power Commission did not follow the recommendation of its predecessor, but, instead, contracted with the Ontario Power Company, after having received tenders from the three power companies located on the Canadian side, for the supply of power up to a maximum of 100,000 horsepower.

By this agreement, dated August 12, 1907, the Company agreed at the expiration of ninety days' notice to deliver 8,000 horsepower or more to the Commission, and to further deliver in blocks of 1,000 horsepower additional power up to 100,000 horsepower.

The agreement was to remain in force for ten years from the date of expiration of the said ninety days' notice, but the Commission was given the option to continue the agreement for one, two or three further consecutive terms of ten years each.

In the case of interruption to service, other than that caused by strikes, lock-out, riot, fire, invasion, explosion, Act of God, or the King's Enemies, or any other cause beyond its control, the Company agreed to permit deduction from its bills, to be made as follows:

"For interruption for less than one hour, double the amount payable for power for the time of such default, and for interruption for one hour or more, the amount otherwise payable for the day."

For this power the Commission agreed to pay the Company \$10.40 per horsepower per annum, when the amount reserved was less than 25,000 horsepower, and when the amount reserved was in excess of 25,000 horsepower the Commission agreed to pay \$10.00 per horsepower per annum.

This was for delivery at 60,000 volts and in 1908 the agreement was amended to provide for the pay-

ment of power for delivery at 12,000 volts at \$9.40 per horsepower year for the first 25,000 horsepower, and \$9.00 per horsepower year for all power in excess of that amount.

By this agreement the Commission was insured of a reasonable low cost for power to the extent of 100,000 horsepower for the next ensuing forty years, and, further, through the penalties imposed by the contract for interruptions to service, it was insured of a satisfactory supply of power.

Comparison of the Cost for Power as Estimated and that Actually Realized

The Ontario Power Commission in preparing estimates as to the cost of power to the several municipalities did so on the basis of a delivery of 30,000 horsepower, 60,000 horsepower and 100,000 horsepower, while the Hydro Electric Commission in 1908, in contracting with fourteen municipalities, included within the contract their estimates as to what the maximum cost of the power to each municipality would be.

In Figure 1 the comparison is made between the cost estimated by the Ontario Power Commission, based on 30,000 horsepower, the estimated maximum cost stated in the contract of 1908, and the actual wholesale rate paid in 1913, when the sales amounted to 37,000 horsepower. It is to be noted that in every instance the wholesale rate realized by the municipalities was lower than that of either of the estimates, so that on this basis these estimates were conservative. However, Figure 2, in which the comparison is made between the estimated costs by the Ontario Power Commission on the 100,000 horsepower basis, and the actual rates realized in 1918, when 144,000 horsepower was being taken, and in 1920, when 189,000 horsepower was being taken on the Niagara System, shows that the estimated cost by the Ontario Power Commission on the basis of selling a larger amount of power was underestimated. The Niagara System first carried greater than 100,000 horsepower in 1915, but unfortunately the Commission, in its annual report for that year, did not give any information by which it is possible to determine the rates paid by the several municipalities, and 1918 is the first year for which such information can be obtained.

It is interesting to note in connection with these comparisons of rates that, while the rates for 1920 in the eastern section of the Niagara System for the cities of Toronto, Guelph, Hamilton, Kitchener, St. Marys and Galt increased, that the rates for the cities lying to the west, such as London, Stratford, Ingersoll and St. Thomas, were lower than those for 1918, but in no case did they begin to approach the estimates of the cost for power prepared by the Ontario Power Commission.

The municipalities selected for this comparison comprised ten out of the eighteen municipalities mentioned in the report of the Ontario Power Commission in 1906, being chosen to give a geographical distribution in the territory included in the studies by that Commission.

Purchase of the Ontario Power Company by the Hydro-Electric Power Commission

The first ten-year term of the contract between the Hydro Electric Power Commission and the Ontario Power Company for the purchase and sale of power would have terminated in August, 1917. Prior to that time, the Hydro Electric Power Commission discussed the purchase of this property with the Ontario Power Company, and, through an agreement dated April 12, 1917, the Commission purchased the capital stock of the Ontario Power Company. The title of this company actually passed to the Commission in August, 1917.

By the terms of this agreement the Ontario Power Company sold to the Commission all of the capital stock of that company for the sum of \$8,000,000, which the Commission paid for with its own debentures, bearing a rate of 4% per annum, payable forty years from their date of issue. The Commission in taking over the stock of the Ontario Power Company assumed the liabilities of the Power Company, of which the funded debt consisted of about \$14,700,000.

In purchasing the Ontario Power Company the Commission obtained control of the Ontario Transmission Company, all of the stock of which was owned by the Ontario Power Company.

Mr. Gaby, in answer to the question as to why the Ontario Power Company was purchased when an advantageous contract was in force, states:

"The Ontario Power Company was purchased so that the Commission could obtain better control of the power supply thus resulting in better and more dependable service to its customers and the municipalities, and was purchased on the basis of its operating conditions and revenue obtaining at the time of the purchase, also to protect the municipalities in their future power supply."

The Purchase of Power by the Commission from the Canadian-Niagara Power Company

By 1916 the Commission's load on the Niagara System had grown to such an extent that it was necessary to purchase power from the Canadian Niagara Power Company in addition to that purchased from the Ontario Power Company. The Canadian-Niagara Power Company is paid \$12.00 per horsepower per year for 12,000 volt delivery, and for the year 1920 sold an average of about 68,000 horsepower to the Commission.

The Growth of Hydro-Electric Service Since 1911

In Figure No. 3, showing the population of the Province of Ontario, the population of the district served by Hydro, together with the number of Hydro customers, it will be seen that for 1911, which was the first year during which Hydro operated for the entire period, the districts served brought Hydro Service available to about 400,000 people, and that the service has increased since that time until in 1920 the districts having Hydro Service

had a population of about 1,700,000 people. The growth of the population to which Hydro Service is available during the past ten years has been at a rate of about 17½% per annum, while the number of consumers served has been at a much higher rate.

By referring to Figure No. 4 it will be noted that the number of Hydro consumers in 1911 constituted about 1.7% of the total population for the Province, but by 1920 these consumers had grown to about 9.4% of the total population. In the district served by Hydro about 10% of the population were Hydro consumers for the year of 1911, and these increased to about 17% for 1920. Hydro Service has now been extended until it is available to approximately 55% of the total population of the Province of Ontario.

The Growth of Water Power Development in the Provinces of Ontario and Quebec

The Water Power Branch of the Department of Interior of the Dominion of Canada has compiled statistics in respect to the growth of water power developments for each of the several provinces in the Dominion. It has in addition made surveys as to the extent of the undeveloped water powers available.

In its report as of January 1, 1920, the Water Power Branch stated that the undeveloped water powers in the Province of Ontario amounted to 5,800,000 horsepower, while those developed produced a total of 1,015,726 horsepower. For the Province of Quebec the undeveloped water powers are shown to be 6,000,000 horsepower, while those developed amounted to 910,029 horsepower. The undeveloped water powers are computed upon the basis of continuous power, and the capacity stated is, therefore, very conservative.

In Figure No. 5 the growth of the water power development for the Province of Ontario and Quebec between the years of 1911 and 1920 inclusive, are shown on a per capita basis. This method of showing the development was chosen in order to eliminate the difference in the population of the two Provinces. Developed water power in the Province of Ontario was 75% greater than that for the Province of Quebec in 1911, a large part of which was due to the developments on the Niagara River at Niagara Falls. In 1915 Ontario was leading the Province of Quebec in the development of its water power on a per capita basis by 12% and in 1920 by 24%.

For the five year period from 1911 to 1915, inclusive, the growth of water power development in the Province of Ontario was at a rate of 6% per annum, and for the Province of Quebec was 15.5%. The following five years from 1916 to 1920, inclusive, was the period of the World War and of exceedingly high prices for construction. During that period Ontario developed its water powers at the rate of 3% per annum, as against the development in Quebec of about 1%. For the entire ten-year period, the rates of water power development per capita for the Province of Ontario has been

about 5% per annum, while for the Province of Quebec it has been about 9%. The results do not include the added capacity that will be brought into service by the Queenston-Chippawa Development or the Nipigon Development in Ontario, or the ad-

ditions of about 60,000 horsepower under construction in the Province of Quebec by the Shawinigan Falls Water Power Company and the Cedars Rapids Development.

Figure 5 is indicative of the difference in the

TABLE NO. 1

CAPACITY AND CHARACTERISTICS OF OPERATING POWER PLANTS OWNED BY THE HYDRO-ELECTRIC POWER COMMISSION IN 1919

Plant Name	Big Chute	Wasdells Falls	Erindale	Ontario Power Co.
Stream	Severn	Severn	Credit	Niagara
System Served	Severn	Wasdells	Niagara	Niagara
Drainage Area Sq. Miles.....	2,247	2,080	80	254,708
Max. Discharge Sec. Ft.....	10,000	9,000	2,360	—
Avg. “ “ “	800	750	—	211,000
Min. “ “ “	260	260	6	168,700
Gross Head Ft.....	62	14.5	50	213
Net Head Ft.	58	14.5	50	180
HP. Capacity	5,600	1,200	2,000	200,000
KVA. “	4,300	800	—	179,000
KW. “	4,000	720	1,200	160,000
Sec. Ft. Flow at Full Capacity..	1,200	1,000	350	13,300
Frequency	60	60	60	25
Total Cost	\$633,890	\$140,787	—	28,757,614
Cost per HP. Installed.....	\$113	\$117	—	\$142
Cost per K.W. Installed.....	\$158	\$195	—	\$179
Date Operation Started.....	July 1, 1914	Oct. 6, 1914	Aug. 1906	1902
Costructed or Purchased.....	Constructed	Constructed	Purchased	Purchased 1917
Transmission Voltage	22,000	22,000	13,200	12,000 30,000 60,000

Plant Name	Healey Falls	Campbellford	Frankford	Trenton
Stream	Trent Canal	Trent Canal	Trent Canal	Trent Canal
System Served	Cent. Ont.	Cent. Ont.	Cent. Ont.	Cent. Ont.
Drainage Area Sq. Miles.....	—	—	—	—
Max. Discharge Sec. Ft.....	—	—	—	—
Avg. “ “ “	—	—	—	—
Min. “ “ “	—	—	—	—
Gross Head Ft.....	76	23	18	20
Net Head Ft.	76	23	18	20
HP. Capacity	16,800	5,500	4,800	—
KVA. “	11,250	3,750	3,250	3,750
KW. “	9,000	3,000	2,600	3,000
Sec. Ft. Flow at Full Capacity..	—	1,930	2,130	2,200
Frequency	—	60	60	60
Total Cost	60	—	—	—
Cost per HP. Installed.....	—	—	—	—
Cost per K.W. Installed.....	—	—	—	—
Date Operation Started.....	1913	1909	1912	1911
Constructed or Purchased	Purchased 1916	Purchased 1916	Purchased 1916	Purchased 1916
Transmission Voltage	44,000	44,000	44,000	44,000

Plant Name	High Falls	Nipissing	Muskoka	Eugenia Falls
Stream	Mississippi	South	Muskoka	Beaver
System Served	Rideau	Cent. Ont.	Muskoka	Eugenia
Drainage Area Sq. Miles.....	450	300	677	74
Max. Discharge Sec. Ft.....	3,490	4,270	4,470	518
Avg. “ “ “	615	225	—	74
Min. “ “ “	72	58	116	20
Gross Head Ft.....	80	92	—	555
Net Head Ft.	78	92	102	530
HP. Capacity	3,600	1,600	1,500	8,800
KVA. “	2,625	1,060	1,200	5,630
KW. “	2,340	900	1,080	4,800
Sec. Ft. Flow at Full Capacity..	445	150	170	140
Frequency	60	60	60	60
Total Cost	\$748,914	\$314,621	\$139,190	\$956,769
Cost per HP. Installed.....	\$208	\$210	\$92.50	\$169.90
Cost per K.W. Installed.....	\$368	\$350	\$128.50	\$200.00
Date Operation Started.....	May 1920	—	1909	November 18, 1916
Constructed or Purchased	Constructed	Purchased in 1916	Purchased in 1914	Constructed
Transmission Voltage	26,400	22,000 2,200	22,000 6,600	22,000 4,000

MURRAY AND FLOOD REPORT

TABLE NO. 1—continued

CAPACITY AND CHARACTERISTICS OF OPERATING POWER PLANTS OWNED BY THE HYDRO-ELECTRIC POWER COMMISSION IN 1919

Plant Name	Fenelon Falls	Auburn
Stream	Trent Canal	Otowabee
Stream Served	Cent. Ont.	Cent. Ont.
Distance from City Miles.....	—	—
Max. Discharge Sec. Ft.....	—	—
Avg. " " " " " " " ".....	—	—
Min. " " " " " " " ".....	—	—
Gross Head Ft.....	24	18
Net Head Ft.....	24	18
H.P. Capacity	1,000	2,850
KVA.	800	1,875
KW.	720	1,500
Sec. Ft. Flow at Full Capacity.. .	550	1,300
Frequency	60	60
Total Cost	—	—
Cost per H.P. Installed.....	—	—
Cost per K.W. Installed.....	—	—
Date Operation Started.....	1896	1912
Constructed or Purchased	Purchased 1916	Purchased 1916
Transmission Voltage.....	44,000	44,000

CAPACITY AND CHARACTERISTICS OF POWER PLANTS UNDER CONSTRUCTION BY THE HYDRO-ELECTRIC POWER COMMISSION

Plant Name	Ramsey's Falls	Nipigon	Chippawa-Queenston
Site	Trent River	Nipigon	Niagara
System Served	Cent. Ont.	Thunder Bay	Niagara
Drainage Area Sq. Miles.	4,400	9,100	254,703
Max. Discharge Sec. Ft.	—	—	—
Avg. " " "	18,000	4,350	211,000
Min. " " "	1,400	—	168,700
Gross Head Ft.	48	77	316
Net Head Ft.	46.5	72	305
HP. Capacity	10,000	25,000	275,000
KVA. "	9,00	21,200	225,000
K.W. "	8,100	17,000	180,000
Sec. Ft. Flow at Full Capacity..	20,600	3,300	9,167
Frequency	60	60	25
Total Cost	\$1,440,000	\$5,600,000	—
Cost per HP. Installed	\$144.00	\$224.00	—
Cost per K.W. Installed	\$178.00	\$330.00	—
Date Operation Started	June 1922	Dec. 1920	—
Constructed or Purchased	Constructed	Still under construc'n	Under construction
Transmission Voltage	44,000	110,000	110,000

policies pursued by governmental and private management. In the Province of Ontario about 50% of all capital invested in electric utilities is vested in governmental bodies, while in Quebec only 4% is owned by governmental agencies. During the five years prior to the war (from 1911 to 1915, inclusive) when the cost of construction was comparatively cheap, the water powers in the Province of Quebec were developed at a rate of nearly three times that for the Province of Ontario, but when the situation was reversed for the ensuing five years from 1916 to 1921, the policies adopted in the two Provinces were also reversed, and the water power development in Quebec fell off to about one-third of that of the Province of Ontario.

Water Power Plants Owned and Under Construction by the Hydro-Electric Power Commission

The Hydro-Electric Power Commission now owns or operates fourteen hydro-electric plants. Seven of these plants are on the Central Ontario System,

which is owned by the Province of Ontario, but which the Hydro Electric Power Commission is operating for the Province's account. Of the balance of the plants operating in 1920, four plants were constructed by the Commission, and three plants were purchased.

The largest plant now operated is that of the Ontario Power Company, located on the Niagara River. This has a capacity of approximately 200,000 horsepower, 40,000 horsepower having been added since its purchase by the Commission in 1917.

There are three hydro-electric power plants being constructed by the Commission at present, viz.: Ranney's Falls, for the Central Ontario System; Nipigon, for the Thunder Bay System, and Queens-ton-Chippawa, for the Niagara System. The total power-plant capacity now under construction is 310,000 horsepower.

It is expected that the Nipigon plant will be operating with a capacity of 25,000 horsepower in the near future, and the latest advice on the Queenston-

Figure 6
Relation of generating capacity, owned by the H.E.P.C.
to the peaks upon the systems served.

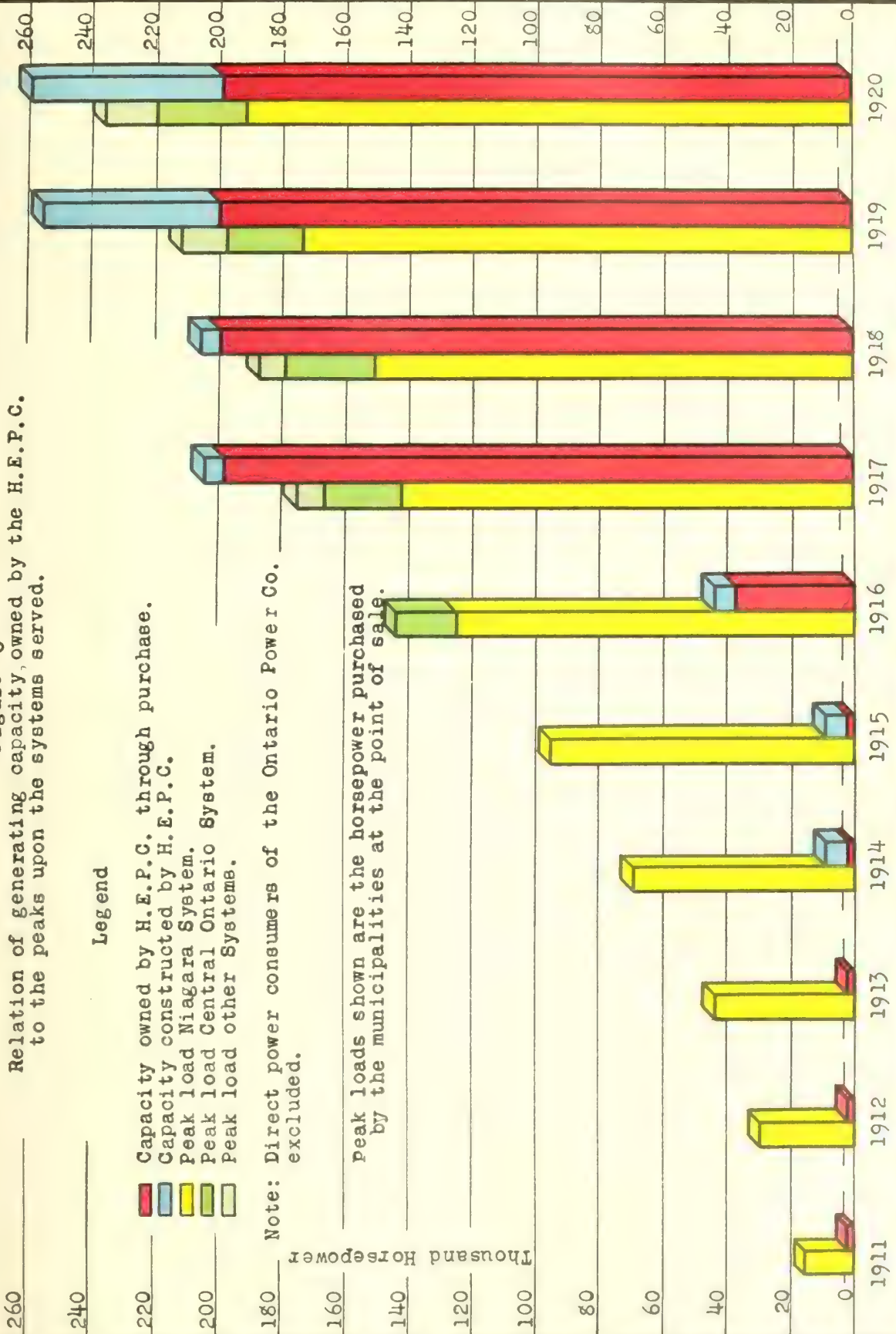
Legend

- Capacity owned by H.E.P.C. through purchase.
- Capacity constructed by H.E.P.C.
- Peak load Niagara System.
- Peak load Central Ontario System.
- Peak load other Systems.

Note: Direct power consumers of the Ontario Power Co. excluded.

peak loads shown are the horsepower purchased by the municipalities at the point of sale.

Thousand Horsepower





Chippawa Development is that the first two units of 55,000 horsepower each will be in operation early in 1922, and the three additional units will be in operation the latter part of 1922.

The characteristic statistics of these several plants are given in Table No. 1.

By 1920 the Commission owned and controlled about 257,550 horsepower in hydro-electric plants which were at that time operated.

During a hearing before the Committee on Water Power of the House of Representatives of the Sixty-Fifth Congress of the United States, held April 15, 1918, the following was brought out:

- Mr. Ferris. "How long has it been since there was any great activity, since large activity began in the territory of Ontario?"
- Sir Adam Beck. "In 1896 or 1898 the first leases were issued at Niagara Falls."
- Mr. Ferris. "And the Province of Ontario issued leases at Niagara in 1896 you say?"
- Sir Adam Beck. "Yes."
- Mr. F. A. Gaby, (Chief Engineer) "The first one was as early as 1887. Then they were revised from time to time, and in 1902 they became operative agreements."
- Mr. Ferris. "And then the great activity began?"
- Sir Adam Beck. "Yes."
- Mr. Ferris. "What I am trying to get at is that the great activity and the large percentage of this 750,000 horsepower of hydro-electric energy was developed in the last fifteen years."
- Sir Adam Beck. "We claim there was not any great activity until we entered the field."
- Mr. Ferris. "And when was that?"
- Sir Adam Beck. "In 1905."
- Mr. Ferris. "Then a fair statement would be that the great activity, the large development of hydro-electric energy from the Province of Ontario was from 1905 to 1918? Is that right?"
- Sir Adam Beck. "From 1902 to 1918."

Later during the hearing the following was brought out:

- Mr. Ferris. "... I wish you would tell us for the record what development in horsepower has actually taken place in the last eight years in which your commission has been in actual operation, where you are granting terms for licenses for a short term, and under regu-

lations and under a reversionary clause and without obligatory agreement on the part of the Government to reply. That is what I want to get."

- Sir Adam Beck. "Well the total leases that have been granted would not exceed five or six hundred thousand in the last ten or twelve years. I am sure of that."
- Mr. Ferris. "Five or six hundred thousand horsepower?"
- Sir Adam Beck. "Yes, but some of those were granted before the Commission came into existence."
- Mr. Ferris. "That is nearly all of the 750,000 horsepower?"
- Sir Adam Beck. "Yes. The three Niagara companies had their leases when we began this work. In fact, the Electric Development Company just previous to our coming into office had been given an additional right to generate 125,000 horsepower, but it required to be validated by an act of the Legislature, and there being a change of Government, we refused to validate that 125,000 horsepower. They did not get the additional power."
- Mr. Ferris. "How much, then, was actually in general use, either from Niagara or any one of the other twelve projects that you have in vogue up there, eight years ago, and how much is actually in use now?"
- Sir Adam Beck. "I do not think more than two or three hundred thousand horsepower."

To one not thoroughly familiar with the history of the situation in the Province of Ontario, the above statements, taken from the record of the hearing before the Congressional Committee, would make it appear that a large portion of the actual water power developments in the Province of Ontario has originated with, and has been originally made under the direction of the Hydro-Electric Power Commission. The actual facts of the situation are brought out in Figure No. 6. This figure shows by years from 1911 to 1920 the amount of hydro-electric power plant capacity controlled by the Hydro-Electric Power Commission, subdivided into that which was actually constructed by the Commission, and that which it obtained through purchase. The chart is not carried back farther than 1911 because before that date the Commission did not own sufficient capacity to show on the chart. This figure also shows the power sold by the Com-

mission to its several systems, as taken from the load curves given in its annual reports, and these peak loads have been subdivided into the Niagara system, which is by far the largest; the Central Ontario system, which is second in size, and the total of the other systems.

Referring to Figure No. 6 it is noted that for 1911 the Hydro-Electric Power Commission controlled hydro-electric power plant capacity sufficient to supply about 11% of the maximum amount of power sold. By 1918 the Commission owned plant capacity sufficient to supply 109% of the maximum amount of energy sold, and by 1920 the amount of plant capacity owned was sufficient to supply 110% of the maximum amount of power sold. However, the Commission during both the latter periods was exporting about 60,000 horsepower to the United States, so that its available plant capacity could supply but 77% in 1918, and about 84% in 1920, of the maximum amount of power sold on the Canadian side of the frontier. There is still another factor that must be considered, and that is the diversity existing between the consumer's loads and the load upon the power plants, which would reduce these ratios somewhat. This has been dealt with in section "D" under the costs for the Ontario Power Company.

In 1911 the Commission had constructed no power plant capacity. By 1918 the amount of capacity constructed by the Commission was 3.1% of the total owned and controlled by it, and this had grown by 1920 to 23% of all capacity owned and controlled by it.

It is apparent from these figures that private enterprise has taken the entire risk in the development of the water power resources of the Province of Ontario. This is emphasized by the figures of the Dominion Water Power Branch of the Department of Interior, which shows the total development of water power in the Province of Ontario, as of May 30, 1921, to be about 1,052,000 horsepower, compared to which the capacity actually constructed by the Hydro-Electric Power Commission as of October 31, 1920, is 60,400 horsepower. In 1918, as of October 31st, the Hydro-Electric Power Commission had constructed plants to about 6,800 horsepower in capacity and if, as stated by Sir Adam Beck, the total then developed water power capacity of the Province of Ontario was 750,000 horsepower, the Commission had constructed less than 1% of this total.

The Power Contracts of the Municipalities with the Hydro-Electric Power Commission in 1919 and 1920

The combined load curves for all of the system operated by the Hydro-Electric Power Commission is given in Figure No. 7 for the years 1919 and 1920. The Thunder Bay and Ottawa systems are not included for the reason that the statistics are not published in the annual report of the Hydro-Electric Power Commission. The figure also includes only that portion of the load of the Ontario

Power Company which is sold directly to the Niagara System.

For the fiscal year ended October 31, 1919, the peak load came in the month of October, and was approximately 210,000 horsepower, while for the fiscal year ended October 31, 1920, the peak load came in the month of September and was about 226,000 horsepower. This growth of the peak load was at a rate of about 7½%. The average load for the fiscal year of 1920, however, showed a growth over that for the fiscal year of 1919 of about 17%. The ratio of the average load to the peak load for 1919 was 88%, while for the year 1920 it rose to 91%.

For the year 1919 the peak load of the several different systems operated by the Commission all came in the month of October, but for the year 1920 the peak loads on the several systems came in different months, causing a diversity factor of 1.025 between the several systems. It is probably as the systems are expanded and increased in number in accordance with the Hydro-Electric Power Commission's present plans that the diversity between the systems will increase, making it advantageous to interconnect them so as to take advantage of joint reserves. The difficulty in doing this will arise from the Commission having adopted different frequencies, namely, 25 cycles on the Niagara System and 60 cycles for all other systems.

The Clean-up Deal

In 1917 the Provincial Legislature passed an Act for the regulation of water powers by which the Lieutenant-Governor in Council was empowered to appoint inspectors to determine not only the water that could be diverted but the horsepower that could be developed from water powers within the Province of Ontario. Should the inspectors find that the Power Company was either taking water in excess or producing power in excess of the amount it was entitled to, the Lieutenant-Governor in Council was empowered to order all excess power delivered to the Hydro-Electric Power Commission of Ontario.

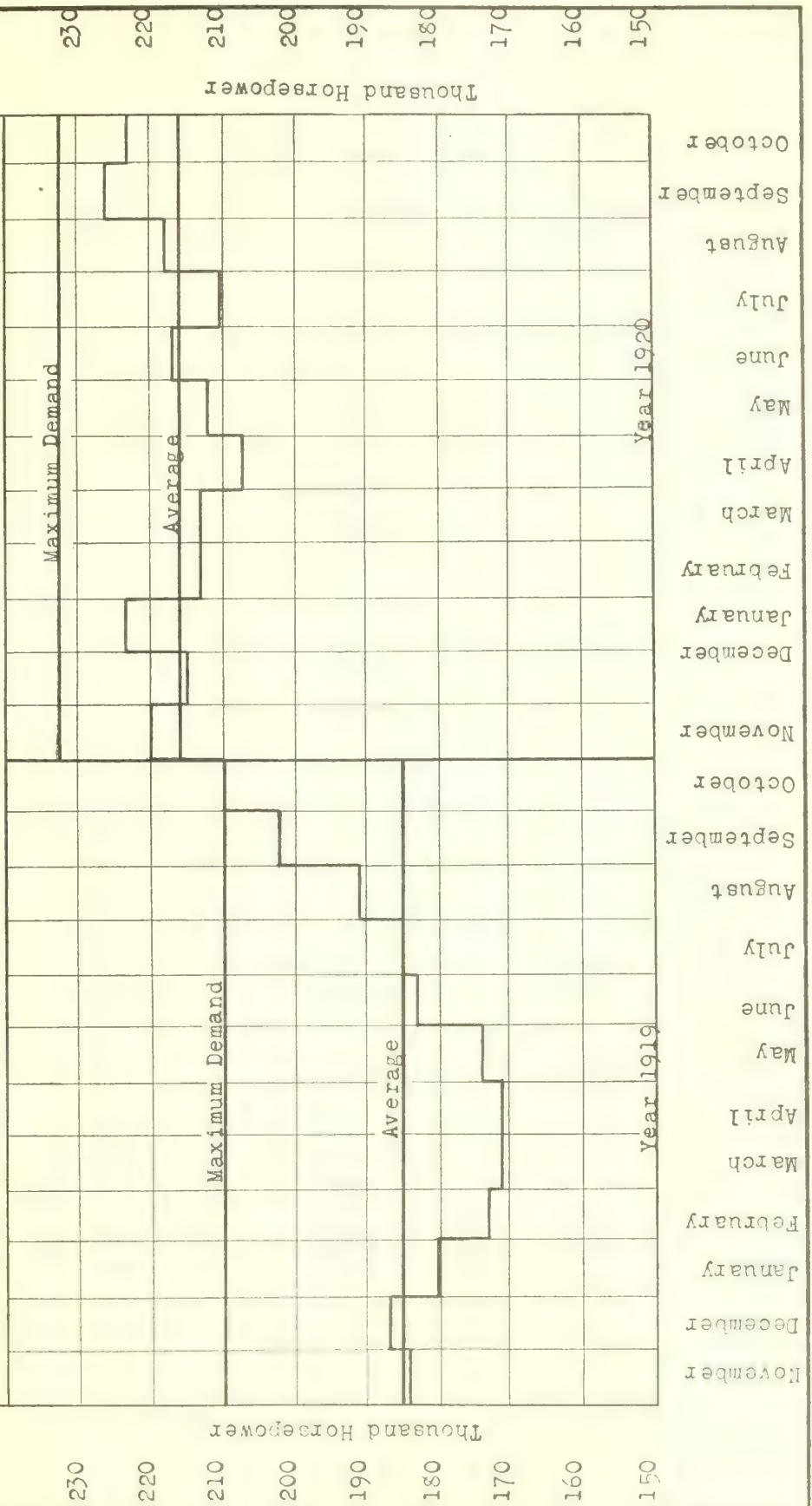
In the latter part of 1917, subsequent to the passage of this Act, a Royal Commission was appointed by the Lieutenant-Governor in Council to inquire into the claims of the Electrical Development Company that it was not receiving adequate water to develop its full capacity. The investigation of this Commission included not only this subject, but inquired as to the amount of commercial horsepower the Electrical Development Company was entitled to, and it rendered a decision as to the amount and value of the excess power developed by this company which should be delivered to the Hydro-Electric Power Commission of Ontario.

In brief, the decision of the Royal Commission allowed to the Electrical Development Company a larger diversion of water than was permitted it by the Order in Council of 1914. The Commission found that the Electrical Development Company was not entitled to develop over 125,000 commercial horsepower although the capacity of its plant was 150,000 horsepower, and that all power in excess of

Figure 7

Actual Load Curve of the Hydro-Electric Power Commission of Ontario exclusive of the Thunder Bay and Ottawa Systems for the years 1919 and 1920.

Note: Peak loads shown are the horsepower purchased by the municipalities at the point of sale.





125,000 horsepower should be delivered to the Hydro-Electric Power Commission for a price of \$9.00 per horsepower per year.

The Hydro-Electric Power Commission in 1918 started to take power under this ruling, from the Electrical Development Company, and the Electrical Development Company protested against the decision of the Royal Commission in respect to the rate which it was allowed for this power taken by the Hydro-Electric Power Commission. A decision was later rendered by the Courts which required the Ontario Power Company to pay to the Electrical Development Company a rate higher than that recommended by the Royal Commission.

The Electrical Development Company was originally owned and controlled by the Mackenzie and Mann interests, which also owned and controlled other utility properties in the city of Toronto through a holding company known as the Toronto Railway Company.

The Toronto Railway Company owns and controls all of the stock of the Toronto Power Company, which in turn owns and controls all but \$13,100.00 of the stock of the Electrical Development Company and all of the stock of the Toronto Electric Company, which is the local electrical distributing company for the city of Toronto.

The Electrical Development Company in turn owns all the stock and bonds of the Toronto Niagara Power Company, which is the transmission company owning the lines and transformer stations between the power plant of the Electrical Development Company at Niagara Falls and the City of Toronto.

In the earlier days of the Hydro-Electric Power Commission, the City of Toronto endeavored to purchase the property of the Toronto Electric Light Company in order to eliminate the duplication of the distributing systems in the city of Toronto, and it offered to pay the stockholders of the Toronto Electric Light Company \$135.00 per share for all the capital stock and to assume all of the liabilities of the company. It furthermore agreed to allow the stockholders to retain the cash then in the treasury of the company. The Toronto Electric Light Company was not at that time directly owned by the Mackenzie and Mann interests, but upon this offer being made by the City of Toronto these interests, through the Toronto Railway Company, purchased the Toronto Electric Light Company at a price substantially the same as that offered by the Municipal Hydro-Electric Commission of Toronto. Thus in Toronto there have been two electric utility interests competing with each other, namely, the Municipal Hydro-Electric Commission of Toronto and the Toronto Electric Light Company, and this competition has resulted in a considerable duplication of the distribution systems, resulting in a greater capital expense than is necessary for the service of this community. The Hydro-Electric Power Commission has had since its inception the power to expropriate the property, but it has not exercised that right, and these competitive conditions have existed over a period of about ten years.

Negotiations have taken place from time to time with respect to the purchase of the various utility properties owned by the Mackenzie and Mann interests. The Toronto Street Railway Company, which was also owned and controlled by the Toronto Railway Company, will be purchased by the City of Toronto and already has been turned over to it for operation since September, 1921. The price to be paid for this company is at present in process of being determined by arbitration.

In December, 1920, representatives of the Toronto Railway Company, of the Hydro-Electric Power Commission of Toronto, and of the City of Toronto, finally came to an agreement regarding the purchase of the several utilities owned and controlled by the Toronto Railway Company. This purchase is popularly known as the "clean up deal." The terms of this purchase are set forth in a letter to Sir Adam Beck by Mr. Robert J. Fleming, General Manager of the Toronto Railway Company, dated December 5, 1920, and since that time the various properties to be taken over, while still being operated by the original owners, are being operated in trust for the proposed purchasers.

The actual agreements for the transfer of these properties have not been signed, but it is expected that the transfer will be made at an early date, inasmuch as there are only certain minor matters to be settled and most of these are points of discussion between the City of Toronto and the Hydro-Electric Power Commission of Ontario, rather than with the owners of the property.

By the terms of a letter addressed to the Mayor and Board of Control of the City of Toronto by Sir Adam Beck, the terms of the "clean up deal" may be stated as follows:

The Hydro-Electric Power Commission, on behalf of the City of Toronto, agrees to buy from the Toronto Railway Company all of the stock of the Toronto Power Company, the Toronto and York Radial Railway Company and the Schonberg and Aurora Railway Company.

The Toronto Power Company owns and controls—

- (a) The Electrical Development Company, which in turn owns and controls the Toronto Niagara Power Company.
- (b) The Toronto Electric Light Company.

In this transaction the Hydro-Electric Power Commission will pay over to the Toronto Power Company for the stock of these three companies:

- (a) \$6,971,295.00 in 20-year, 6% bonds of the City of Toronto.
- (b) \$2,375,000.00 in 20-year, 6% bonds of the Hydro-Electric Power Commission of Ontario.
- (c) \$612,528.00 in 20 year, 6% bonds of the Hydro-Electric Power Commission of Ontario.

The Commission will further assume \$22,775,-177.00 of indebtedness of these several companies, making the total purchase price \$32,734,000.00.

Of the total purchase price, the Hydro-Electric

Power Commission of Ontario either pays in its own money or assumes the indebtedness of the companies taken over, to the extent of \$22,547,705, and in return for this money obtains the ownership of the Electrical Development Company's plant, the transmission line and transformer stations of the Toronto and Niagara Power Company and the steam electric plant in the City of Toronto. The Commission will own the Toronto and York Radial Railway free from debt, obligating itself to issue \$2,375,000 of its bonds for its purchase. The Hydro-Electric Power Commission, accordingly, through the issuance of its own securities and by assuming the liabilities of the property taken over, will have increased its liabilities \$24,922,705.00 by this transaction.

The City of Toronto, either through the issuance of its own debentures or through assuming the bonds of the Toronto Electric Light Company, increases its liabilities by \$7,811,295.

Mr. Gaby, in answer to the questions given in Section "A," asking the reason for the proposed purchase of the Electrical Development Company, by the Commission, states:

"To conserve and prevent economic loss due to the duplication of systems within the Niagara District and the properties could be purchased with existing contracts on a self-supporting basis."

The Hydro-Electric Power Commission's Commitments for Future Power Developments

In addition to the purchase of the Electrical Development Company just described, the Hydro-Electric Power Commission has under construction three new power developments, the details of which have been previously described. The two larger of these are the development on the Nipigon River and the Queenston-Chippawa Development on the Niagara River, and these powers, when completed to their proposed ultimate capacity, will make available to the Thunder Bay district and the Niagara district a very much greater amount of power per capita than is now obtainable. The Niagara System proper for the fiscal year ending October 31, 1920, had available about 223,000 horsepower, including power purchased by the Commission from the Electrical Development Company and the Canadian-Niagara Power Company, but excluding the exportation of power to the United States by the Ontario Power Company, and this capacity amounts to about 191 horsepower per 1,000 of population for the Niagara district. Adding to this the commercial horsepower for the Niagara System that will be made available by the purchase of the Electrical Development Company, and also adding the capacity available from private companies in the Niagara district, but deducting the exported power to the United States by the Electrical Development Company above, shows there is available in the Niagara district a total of about 356 horsepower per 1,000 of population. The proposed ultimate capacity for the Queenston-Chippawa Development is 650,000 horse-

power and, estimating a portion of Ontario Power Company plant closed for the lack of water, will give the Niagara district a total power plant capacity of about 960,000 horsepower, after deducting the power now exported to the United States. This amount of capacity would make available about 814 horsepower for each 1,000 of population on the Niagara district, which is over four times as great as that available from the Commission's power plants at present, and over twice as great as that now available from all sources.

The total population served from the Thunder Bay System is approximately 35,000. The Commission is just completing a plant on the Nipigon River with a present capacity of 25,000 horsepower, thus making available within the district 715 horsepower per 1,000 of population, or nearly 3.7 times as much as is now available for the people of the Niagara district. However, the ultimate capacity of the Nipigon Development is 75,000 horsepower, which will make available over 2,000 horsepower per 1,000 of population, or over 3 times as much as is now available for the Commission's plant for the people of the Nipigon System. In addition to the Commission's capacity on the Nipigon River, there is 35,000 horsepower owned by private interests in this district, so the total capacity available for the district would be 110,000 horsepower, or over 3,000 horsepower per 1,000 of population, which is nearly four times that for the power developments, both municipal and private, now proposed for the Niagara district. The power plant capacity available per 1,000 of population for each of the several systems of the Commission is given in Figure No. 18 of Section G.

The Extent of the Hydro-Electric Power Commission's Transmission System

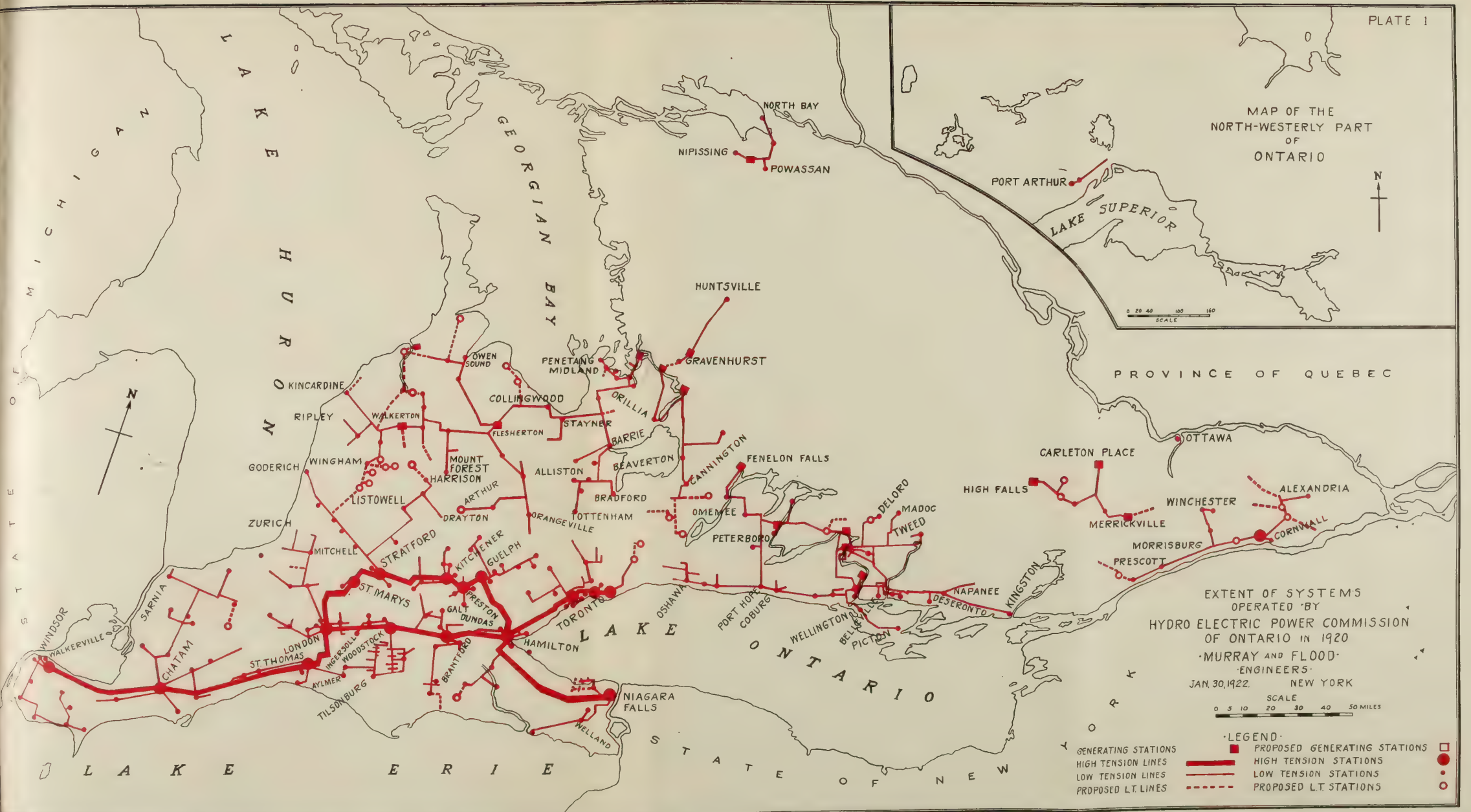
As of October 31, 1920, the Hydro-Electric Power Commission had transformer and distributing stations to the capacity of nearly 1,000,000 horsepower.

The total route miles of 100,000 volt transmission lines were 536, while the circuit route miles were 740. In addition there were 2,335 route miles of transmission and distribution lines owned by the Commission on behalf of the municipalities and operating at voltages from 44,000 to 2,200 volts. These figures do not include any of the distribution systems owned directly by the municipalities in the several cities, towns and villages in the province.

Organization of the Hydro-Electric Power Commission

The Hydro-Electric Power Commission of Ontario is composed of three members. The Chairman, Sir Adam Beck, has held that office since the formation of the Commission in 1907. The other two members of the Commission are Colonel Carmichael, who was appointed soon after the present Government took office, and Mr. Frederick Miller, who was appointed in the Fall of 1921 by Premier Drury. The staff of the Commission is headed by Mr. F. A. Gaby, Chief Engineer; Mr. W. W. Pope,

MAP OF THE
NORTH-WESTERLY PART
OF
ONTARIO



EXTENT OF SYSTEMS
OPERATED BY
HYDRO ELECTRIC POWER COMMISSION
OF ONTARIO IN 1920
MURRAY AND FLOOD
ENGINEERS
JAN. 30, 1922. NEW YORK

SCALE
0 5 10 20 30 40 50 MILES



Secretary; Mr. J. W. Gilmore, Treasurer, and Mr. W. G. Pierdon, Accountant. Each of these executives has a staff for carrying on the work of the Commission.

SECTION C—(PART II)

LAWS IN RESPECT TO THE AUTHORITY OF THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO AND THE RELATIONS OF THE PROVINCE AND MUNICIPALITIES TO THE COMMISSION

The laws enacted by the Provincial Legislature of Ontario with respect to the existing Hydro-Electric Power Commission were first placed upon the statute books in 1906 and have been amended from time to time up to the present.

The activities of the Hydro-Electric Power Commission have been largely increased through separate amendments and additions, and the powers and functions of this Commission as legally granted by the Legislature of the Province are outlined under headings 1 and 2, inclusive, following:

1. Laws Relating to the Appointment of the Hydro-Electric Power Commission of Ontario and the Keeping of Their Accounts

Appointment of Hydro-Electric Power Commissioners:

The Commission, consisting of three members, is appointed by the Lieutenant-General in Council, two of whom may be and one of whom shall be a member of Executive Council.

The tenure of office is at the pleasure of the Lieutenant-General in Council.

By the original law of 1906, the salary of the Commissioners was left to the discretion of the Lieutenant-General in Council. This was amended in 1912 and the salary of the Chairman was restricted to not greater than \$6,000 per annum, payable out of the Consolidated Revenue Fund of Ontario. In 1914, further amendment was added, by which the municipal corporation shall annually pay "such sum not exceeding \$15,000 per annum as the Lieutenant-General in Council may direct to the Chairman and other members of the Commission as remuneration for their services in addition to any sum payable to them out of the Consolidated Revenue Fund." In addition to the salaries paid to the Commission through the above laws, the Chairman of the Commission receives additional compensation as the President of the Ontario Power Company. Several of the other officers of the Commission, such as the Chief Engineer, the Secretary and the Treasurer, also receive compensation for their services in connection with the Ontario Power Company, in addition to that paid to them directly by the Commission.

The Commission in 1906 was given the power to charge the salaries and expenses of the officers of the Commission to the various works of the Commission, except that where not properly chargeable,

they may be payable out of such moneys as may be appropriated for the purpose by legislature.

"The apportionment by the Commission of such salaries, traveling and other expenses shall be final." 6 Geo. V, c. 19, s. 3.

Books and Accounts to be kept by the Commission:

Until 1916, the law did not define the books and accounts to be kept by the Commission. In 1916, the Comptroller of the Commission was directed by legislature to keep a system of accounts, subject to the approval of the Commission; these books at all times to be open to inspection by any person appointed by the Commission for that purpose, and the law provides that these books shall be audited either by the Auditor-General of the Province, or by an auditor to be employed by the Commission with the approval of the Lieutenant-Governor in Council.

By Act 6, Geo. V, c. 19, s. 3, the Commission is required to report to the Treasurer of Ontario before the 15th day of February of each year with regard to the following:

- (a) As to the assets and liabilities (direct and indirect) as of December 31st preceding.
- (b) As to the cash transactions, including receipts and disbursements for the year ending December 31st preceding.
- (c) As to revenues, income and interest earned and expenses in connection with the operation, maintenance and administration of the undertaking for the year ending December 31st preceding.
- (d) As to the sources and expected amounts of income and the payment, loans and advances and purpose of same for the next succeeding year.
- (e) As to the amounts and particulars of liabilities for the next succeeding year.
- (f) As to the securities and evidences of indebtedness which it is contemplated will be created, issued and sold for the next succeeding year.

By the above act of 1916, the Provincial legislature could have been put in a position to not only know the book cost of the undertaking, but also the amounts of money that would be required by the Commission during the succeeding year to be raised by such legislative enactment. However, in 1918, by an amendment of 8 Geo. V, c. 14, s. 3, the law was so changed that it was unnecessary for the Commission to inform the legislature as to the revenues and expenses for the previous year and as to the amounts of money that would be required for the succeeding year. This latter amendment changed the 1916 act to the following:

- (a) A statement of assets and liabilities as of October 31st last preceding.
- (b) A statement of capital costs of each system operated by the Commission.
- (c) This section of 1916 act was repealed.
- (d) A statement showing the operating surplus and deficit, charges for repairs and

*in all
affairs
of the
Province*

charges for sinking fund for each municipality on October 31st.

Profits earned by each system from the sale of power to other than municipal corporations.

Statement of amount of indebtedness due or owing by municipal or other corporations to the Commission.

2. Powers Granted to the Hydro-Electric Power Commission by the Legislature of the Province of Ontario

Powers Granted by the Power Commission Act of 1900:

- (1) To acquire lands, water powers and works.
- (2) To acquire plant and property of transmission companies and to construct transmission systems.
- (3) To contract for the supply of power to the Commission.
- (4) To expropriate property, plants, equipment, etc.
- (5) To hear complaints as to rates charged by private companies, municipalities or by the Commission and to have powers authorized, to be conferred upon a commissioner under the Act Respecting Enquiries Concerning Public Matters.
- (6) To report upon water powers when required by the Lieutenant-General in Council.
- (7) "No action shall be brought against the Commission or against any member thereof for anything done or omitted in the exercise of his office without the consent of the Attorney-General for Ontario." 6 Edward VII, c. 15, s. 21.
- (8) To apportion the cost of the system to the several contracting municipalities.
- (9) That the power expropriation shall extend to all properties notwithstanding the same is or may be devoted to public uses.

Powers Granted by the Power Commission Act of 1907:

- (10) To supply power to railways and distributing companies.
- (11) "Neither the Province nor the Commission nor any member thereof shall incur any liability by reason of an error or omission in any estimates, plans or specifications prepared or furnished by the Commission." 7 Edward VII, c. 19, s. 24.

Powers Granted by the Power Commission Act of 1908:

No additional authority granted.

Powers Granted by the Power Commission Act of 1909:

- (12) To acquire easements.

Powers Granted by the Power Commission Act of 1910:

- (13) Power of entry for construction of a line.

Powers Granted by the Power Commission Act of 1911:

- (14) The right to approve the distribution works of a municipality or of a private company.

- (15) "The Commission shall have exclusive jurisdiction as to all matters in respect of which authority is, by this Act, conferred upon it, and nothing done by the Commission within its jurisdiction shall be open to question or review in any action or proceeding or by any court." 1 Geo. V, c. 15, s. 6.
- (16) "No court shall have authority to grant or shall grant an injunction or other order restraining either temporarily or otherwise, the construction, maintenance or operation of any works, the location and mode of construction after it shall have been approved by the Commission, if the same are being or have been constructed in the place and according to the mode which have been so approved." 1 Geo. V, c. 15, s. 7.

Powers Granted by the Power Commission Act of 1912:

- (17) The right of flooding lands and of improving water powers.
- (18) The right of acquiring distribution plants by purchase or by expropriation.
- (19) The right of abandoning lands after expropriation.
- (20) The right to regulate equipment in electrical works owned by either municipalities or by private corporations.
- (21) The right to require municipalities to appoint inspectors to see that the above regulations are carried out.
- (22) The right to order changes in equipment to conform with the above regulations.
- (23) The right to prescribe a system of book-keeping by which municipalities shall keep their accounts.
- (24) "Whenever it appears from the accounts of a municipal corporation—after providing for the payments required by this Act, that there is a surplus at the credit of the municipal corporation, such surplus shall be applied and disposed of in such manner as the Commission may, by general regulation or special order, direct."
 - (a) To reduce indebtedness.
 - (b) In the maintenance, repairs and renewal of works.
 - (c) In the extension of works.
 - (d) In the formation of a fund to be used in the future for any purpose." 2 Geo. V, c. 14, s. 22C.
- (25) To order the wires of a municipality or a company underground.
- (26) To require persons or a corporation to place their lines in underground tunnels constructed by a municipality, the construction of which tunnels shall be subject to the approval of the Commission.

Powers Granted by the Power Commission Act of 1913:

No additional authority granted.

Powers Granted by the Power Commission Act of 1914:

- (27) To acquire flooded lands on behalf of a municipality.

Powers Granted by Hydro-Electric Railway Act of 1914:

- (28) To investigate and report to the Lieutenant-General in Council on the cost of constructing and operating railways in any locality, the probable revenue and the practicability of the undertaking.
- (29) To make agreements for the construction and operation of railways by the Commission.

The Agreement which is a part of the law gives to the Commission the following powers:

- (a) To construct and operate railways.
- (b) To issue bonds to cover the capital cost.
- (c) To regulate and fix the fares and rates of toll.
- (d) To combine the property and works of the railway and power lines of the Commission where such combination is feasible and may prove economical.
- (e) To permit interchange of traffic with other railways.
- (f) To supply electrical power for the operation of the railways at rates consistent with those charged to municipal corporations.
- (g) To apportion annually the capital costs and operating expenses of all works, etc.
- (h) To apply revenue to the payment of operating expenses, administration and annual charges for interest and sinking fund on money invested and to set aside from any revenue thereafter remaining an annual sum for the renewal of any works.

- (30) The Commission is empowered to raise money for construction by the issue for and on behalf of the municipal corporations of bonds which shall be payable in 50 years from date of issue. The Commission is relieved of raising any sinking fund for the retirement of bonds until after the expiration of the first ten years of the said period.

- (31) The Commission shall not be liable in any manner for the payment of such bonds except to the extent of the moneys received by the Commission as revenue from the operation of the railway after the payment of working expenses, including the cost of electrical power and energy and the cost of administration.

- (32) The Commission shall annually adjust and apportion the amounts payable by municipal corporations. "No action or prosecution shall be brought against the Commission or any member thereof or any of its officers or anything done under this Act without the consent of the Attorney-General of Ontario." 4 Geo. V, c. 13, s. 15.

- (33) "The Province shall not, nor shall the Commission, nor any member thereof, incur any

liability by reason of any error or omission in any of the estimates, plans or specifications prepared or furnished by the Commission." 4 Geo. V, c. 31, s. 16.

- (34) The railways are vested in the Commission in trust for the municipal corporations.

Powers Granted by the Power Commission Act of 1915:

- (35) The Commission is granted the power to sell lands no longer required for the purpose of the Commission.
- (36) The right to remove trees or obstructions, besides the right of way.
- (37) Repeals rights of municipalities to appoint inspectors who shall be appointed by the Commission.
- (38) "Notwithstanding any provisions contained in the contract or agreement entered into between a municipal corporation and the Commission provided for the determination of questions arising under the contract or agreement, or for the settlement of any dispute between the municipal corporation and the Commission by the Lieutenant-Governor in Council or in any other amendment, the Commission may bring an action for any breach of contract or agreement on the part of the municipal corporation and the court may, in any such action, grant an injunction restraining the municipal corporation from doing any act or continuing any such breach"—5 Geo. V, c. 19, s. 15 part.

Powers Granted by the Power Commission Act of 1916:

- (39) Grants Commission power to appoint a sole arbitrator in lieu of the usual method of appointing arbitrators as provided by the Ontario Public Works Act.
- (40) The right to purchase and sell supplies to municipalities.
- (41) The right to undertake the installation of facilities for any municipal corporation.
- (42) The right to cut off the supply of energy to any municipality or private corporation who does not make changes in their facilities as ordered by the Commission.

Powers Granted by the Central Ontario Power Act of 1916:

- (43) The Lieutenant-Governor in Council mayby order in council vest in any Commission.....the ownership or control or power administration and management of all or any of the undertakings..... of all or any of the twenty-two companiesfor such purpose and on such terms.....as such order in council may provide and thereupon, such Commissionshall be clothed with.....all the rights, powers and privileges in respect to such undertakings.....as shall

granted by such order in council." 6 Geo. V, c. 18, s. 6.

In 1919, the Province of Ontario through the Hon. George Howard Ferguson, Minister of Lands, Forests and Mines, purchased the Electric Power Company, Ltd., for \$3,350,000. By order in council, this property was turned over to the Commission for operation.

Powers Granted by the Ontario Niagara Development Act of 1916:

- (44) The Commission is authorized to enter on and lay out land required for the Ontario Niagara Development.
- (45) To acquire options and to make contracts for the purchase of lands.
- (46) To construct the works.
- (47) To keep special accounts showing the money received and an accurate and detailed statement of the cost of the work.
- (48) To permit such accounts to be examined and audited at least annually by an accountant nominated by the Lieutenant-Governor in Council.
- (49) "The additional cost to the municipalities of the power procured under the authority of Sec. 1 shall be included in the price per horsepower, payable by a municipal corporation under the terms of the contract entered into with the Commission and shall be annually adjusted . . . by the Commission as provided by the Power Commission Act." 6 Geo. V, c. 20, s. 6.
- (50) "The exercise of the powers which may be conferred by or under the authority of this Act or of any of them, shall not be deemed to be making use of the waters of the Niagara River to generate electric or pneumatic power within the meaning of any stipulation or condition contained in any agreement entered into by the Commissioners for the Queen Victoria & Niagara Falls Park. . . ." 6 Geo. 7, c. 20, s. 6.

Powers Granted by the Power Commission Act of 1917:

- (51) To acquire stock in any development company.
- (52) To issue bonds, etc., to pay for shares in development companies.
- (53) The Commission may direct that the surplus of municipal corporations be used for the construction of buildings, for the use of Municipal Hydro-Commissions and has power to approve of site, plan and cost of all such buildings.

Powers Granted by Ontario-Niagara Development Act of 1917:

- (54) "Notwithstanding anything contained in any contract heretofore entered into between the Commission and any municipal corporation or corporations, or in any general or special Act, fixing the maximum price of

power to municipal corporations at Niagara Falls, every municipal corporation which has heretofore entered into or which may hereafter enter into a contract for the supply of electrical or pneumatic power or energy, by the Commission from the Niagara River, shall pay to the Commission a sum equal to the average cost per horsepower to the Commission of all the power supplied to the municipal corporations under contract with the Commission for the supply of power from Niagara Falls and the vicinity.

Except as qualified or amended by this Act, all the terms of the said agreement of the 4th day of May, 1908, shall continue in force and apply as far as practicable in the same manner and to the same extent as if this Act had not been passed." 7 Geo. V, c. 21, s. 5.

- (55) "Subject to the approval of the Lieutenant-Governor in Council, the Commission may contract from time to time with any company or individual for the supply of electrical power or energy from the works constructed or acquired under the authority of this Act to such company or individual." 7 Geo. V, c. 21, s. 7.

Powers Granted by the Power Commission Act of 1918:

- (56) To divert all income whether from ordinary revenue or trust fund into a General Fund and to pay all expenditures out of this fund "without regard to special trusts or purposes."
- (57) The Commission is empowered to use any surplus in its hands from any municipality as security against future obligations to the Commission, providing it allow the municipality interest at the rate of 4% per annum.
- (58) The Commission may invest funds other than sinking funds in debentures or other securities of the Dominion of Canada or the Province of Ontario.
- (59) The Commission is empowered to lease or operate works for the generation, transmission, distribution or use of electrical energy of any firm, person or corporation, on such terms as the Commission may arrange with the owner.
- (60) The Commission may borrow money from time to time for purposes of the Commission and issue bonds, debentures and other securities of the Commission therefor.
- (61) The power of the Commission to purchase and sell supplies is enlarged so that in addition to purchasing for and selling to municipal corporations, the Commission may purchase for and sell to other persons, firms and corporations.
- (62) The Commission is empowered to manufacture electrical, hydraulic and other

machinery and to acquire patents of invention and to sell and dispose of machinery, and the profits and losses arising from such operations shall be adjusted and apportioned among the municipalities having contracts with the Commission or be otherwise applied as the Commission may see fit.

- (63) The Commission is empowered to undertake and carry out construction for the municipalities and to charge such municipalities with the cost of any work done by the Commission.
- (64) The purchase of all lands acquired by the Commission and the expenditures of the Commission in the erection of office and other buildings, etc., are confirmed and such expenditures by the Commission shall be repayable to the Commission by municipal corporations by annual sums sufficient to form in thirty years a sinking fund for the payment of the cost thereof.
- (65) "The Commission may from time to time during the first three years that any municipality shall first begin to take power from the Commission, extend the time for payment of the sums payable by any municipality or any part thereof . . . at such a rate not exceeding 7% per annum as the Commission may determine." 8 Geo. V, c. 14, s. 12.
- (66) The Commission shall have the right to make connections between two systems and the cost of power taken by one system from any other shall be dealt with by the Commission as the cost or part of the cost of power to be paid by the municipalities forming part of such system.
- (67) In connection with the apportionment of the cost to the municipal corporations, the following Act was passed in 1918: "The adjustment and apportionment made by the Commission shall be final and binding upon the municipal corporation." 8 Geo. V, c. 14, s. 14.

Powers Granted by the Power Commission Act in 1920-1921:

- (68) The Commission is empowered to acquire by purchase or otherwise or to construct and operate works for the production of electrical power by use of coal, oil or by any other means whatsoever.
- (69) "Notwithstanding anything contained in Section 21, it shall not be necessary to obtain the approval of the Lieutenant-Governor in Council to any contract for a supply of electrical power or energy by the Commission to any person from works which the Commission has acquired or constructed and is operating for the distribution of electrical power and energy." 10-11 Geo. V, c. 18, s. 3-part.

Where the Commission enters into an

agreement to supply power or for any other work to be done and such agreement is approved by the Lieutenant-Governor in Council "such agreement shall be confirmed and be valid and binding upon the parties thereto and shall not be open to question upon any grounds whatsoever, anything in this Act or any other Act to the contrary notwithstanding." 10-11 Geo. V, c. 18, s. 3-part.

- (70) "Where the appropriation made by the legislature for any work of the Commission shall become exhausted in any fiscal year and the Chairman reports to the Lieutenant-Governor in Council that it is necessary and expedient that such work shall be proceeded with and that an additional sum is required for that purpose, the Lieutenant-Governor in Council may order a special warrant to be prepared, to be signed by the Lieutenant-Governor for the issue of the amount estimated to be required in such fiscal year, and when issued such amount shall be placed by the Treasurer of Ontario to the credit of a special account against which cheques may be issued in favor of the Commission for such amounts as shall be required." 10-11 Geo. V, c. 18, s. 4.

Powers Granted by the Hydro-Electric Railway Act of 1920-1921:

- (71) The agreement between the Commission and the Municipalities may include the purchase or lease of any steam railway, electric railway or street railway or any part or parts thereof, or the obtaining of the running rights over the same.

3. Laws as to the Responsibility of the Province of Ontario under the Power Commission and Other Acts

By the Power Commission Act:

In 1917, the Power Commission Act was amended so that land owned by and vested in the Commission is subject to assessment and taxation for municipal and school purposes, but buildings, machinery, works, etc., were continued exempt from assessment and taxation.

The Lieutenant-Governor in Council is authorized to raise the funds necessary for the work of the Commission, and, where legislature has appropriated money for the purposes of the Commission, such money shall be payable to the Commission from time to time upon the requisition of the Chairman of the Commission.

The Lieutenant-Governor in Council, on such terms as may be approved by order in Council, agrees to guarantee the payment of the principal and interest of any bonds, debentures and other securities issued by the Commission. The Lieutenant-Governor is further authorized, on behalf of the Province of Ontario, to enter into any covenants or agreements in connection with the acquisition by

the redemption of any shares of any incorporated company and to guarantee the observance and performance by the Commission of any contract or agreement of the Commission in relation to such acquisition.

The Lieutenant-Governor in Council may guarantee the payment of advances made by banks or any other indebtedness incurred by the Commission.

The Province requires the Commission to invest all sums received by the Commission from municipal corporations and others on sinking fund account in securities of the Province of Ontario and to deliver such securities to the Treasurer of Ontario as security for repayment of advances made by the Province.

The Province further requires the Commission to pay the Treasurer of Ontario, annually, interest on the indebtedness of the Commission to the Province for moneys advanced to the Commission by the Province.

By the Hydro-Electric Railway Act:

The Lieutenant-Governor in Council may authorize the Treasurer of Ontario, for and on behalf of the Province, to guarantee the payment of bonds issued by the Commission for the construction of radial railways. "It is declared that all bonds heretofore or hereafter issued by the Hydro-Electric Power Commission of Ontario for the construction and equipment of a railway—shall constitute a first mortgage charge upon the railway . . . and the holder of any such bonds upon default of payment thereof, in addition to any other remedy or recourse, shall, on behalf of himself and all other bondholders, have the same rights and remedies as a mortgagee of the said railway. . . ." 10-11 Geo. V, c. 57, s. 5.

By the Water Powers Regulation Act:

The Lieutenant-Governor in Council may appoint Inspectors who may enter and inspect any works and take measurements and make tests in order to determine the quantity of water used, the operating head, the electrical and hydraulic efficiency, the amount of power developed, permitted to be developed, or available for development, and to fix, in terms of cubic feet per second, the amount of water necessary to use in order to develop or generate any amount of horsepower, or to exercise any water rights for any purpose.

The Inspector may require the productions of books, records, maps and any other documents, and if it appears to the Inspector that the water permitted to be used is not utilized with a proper degree of efficiency, or that any part of the works have so depreciated that the water cannot be used with a proper degree of efficiency, after giving the interested parties a reasonable opportunity to be heard, he may order the water to be used, or the machinery, or the works, or any part of them, to be replaced, removed, altered, or reconstructed, and if such order is not carried out within a reasonable time, he may enter the works and shut off or reduce the supply of

water, or close the works until such order has been obeyed.

However, when such an order has been given, appeal is allowed from the order to the Lieutenant-Governor in Council.

"Whereas any lease, license, order in Council or any other instrument or any general or special statutory provision confers or purports to confer the right to develop or generate power measured expressly or impliedly in horsepower, or where any such instrument or provision confers or purports to confer the right of diversion or use of water defined wholly or in part by the character, location or dimension of works, the Inspector may fix in terms of cubic feet per second the amount of water which is necessary to use in order to develop or generate such power or to exercise such right having regard to the location of the works and to all circumstances of the case and to the degree of efficiency which the owner of the water power should be required to maintain in the premises." 6 Geo. V, c. 21, s. 7.

Where the rights of the owner of a water power to use water do not appear to be expressly or impliedly limited as to the quantity of water to be used, or as to the amount of horsepower which may be generated, and the Lieutenant-Governor in Council deems it desirable in the public interest that such rights should be specifically limited and defined, he may appoint an Inspector to report upon the amount of power which the owner is authorized to generate and as to the quantity of water which it is necessary to use for the purpose of generating such amount of power, and upon such report the Lieutenant-Governor in Council may determine in horsepower the amount of power which the owner shall generate and, in terms of cubic feet per second, the amount of water which it is necessary to use in order to develop or to generate such power.

If the owner is dissatisfied with such limitation, the Lieutenant-Governor in Council may direct a reference to ascertain what rights have been restricted or impaired, and, if it is found that such rights exist, to ascertain the compensation that should be paid to the owner for such restriction or impairment.

Where the Inspector reports that the owner of a water power is diverting or using more water than such owner is entitled to, or is developing or generating a greater amount of power in horsepower than he is entitled to, or has installed works and equipment capable of developing or generating a greater amount of power than such owner is entitled to develop, the Lieutenant-Governor in Council may appoint three Commissioners to hold an inquiry as to the quantity of water and the amount of power the owner is entitled to, the extent by which the works of the owner exceeds the amount of power which the owner is entitled to, and the price, terms and conditions that power, to the extent of such excess, should be delivered to the Hydro-Electric Power Commission of Ontario.

"Where the owner is developing electrical power

or energy by the diversion of the waters of the Niagara River under any contract, agreement, license, lease or other instrument entered into by the owner or his predecessors in title with or granted to the owner or his predecessors in title by the Commissioners of the Queen Victoria-Niagara Falls Park and the owner diverts or uses more water than he is entitled to divert or use, or develops or generates a greater amount of electrical energy than he is entitled to develop or generate under the contract, agreement, license, lease or other instrument, the Inspector may, with the authority of the Lieutenant-Governor in Council, give the said owner notice in writing to cease diverting or using more water than he is entitled to divert or use, or generating or developing a greater amount of electrical power or energy than he is entitled to develop or generate, and if the owner after the expiration of one month from the giving of said notice diverts or uses more water than he is entitled to divert or use, or develops or generates a greater amount of electrical power or energy than he is entitled to develop or generate, then every franchise or right of occupancy or possession, or right to develop or use any of the waters of the Niagara River, or to operate or construct any works which may be enjoyed by the owner therefor, and notwithstanding anything contained in such contract, agreement, license, lease, or other instrument, or in any by-law or any general or special Act of this Legislature shall cease and be at an end." Amendment 10-11 Geo. V, c. 19, s. 2.

"The Lieutenant-Governor in Council may at any time rescind any order made by him under Sub-Section 2 of Section 13 of this Act and thereupon, all right of the owner to develop power or use water or develop or generate power in excess of the owner's rights as found by the same Commissioners, shall cease." 10-11 Geo. V, c. 19, s. 2.

4. Laws Passed by the Legislature of the Province of Ontario in Respect to the Responsibility of the Municipalities and Their Voice in the Management of Their Properties under the Trusteeship of the Hydro-Electric Power Commission

By the Power Commission Act:

In 1908 certain actions were brought by rate-payers of the cities of Toronto and London to set aside the contracts between the Commission and those municipalities on the ground of misrepresentation on the part of the Commission regarding the obligations of these cities. The Court held that under the Power Commission Act, a fiat of the Attorney-General was necessary to enable the actions to be tried and the Attorney-General, Sir James Whitney, refused to grant a fiat upon the ground that he "could not divest himself of the knowledge that the Act was intended to validate the contracts in question."

Under the Power Commission Act of 1909, the following was passed by the Legislature: "Every action which has been heretofore brought and is now

pending, wherein the validity of the city contract or any by-law passed or purporting to have been passed, authorizing the execution thereof by any of the Corporation hereinbefore mentioned, is attacked or called into question or calling in question the jurisdiction, power or authority of the Commission or of any municipal corporation or the councils thereof, or of any or either of them to exercise any power or to do any of the acts which the said recited Acts authorize to be exercised or done by the Commission or by a municipal corporation or by the council thereof, by whomsoever such action is brought, shall be and the same is hereby forever stayed." 9 Edward 7, c. 19, s. 8.

Any municipal corporation may apply to the Commission for the supply of electrical power to the corporation. The Commission shall furnish the corporation with a statement of the maximum price per horsepower at which the electrical energy will be supplied and an estimate of cost of constructing a transmission line over which the energy is to be supplied, and may furnish the corporation with plans, specifications, etc., for the distribution plant. The council of the municipal corporation may enter into a provisional contract with the Commission for the supply of power, but this shall not be binding upon the corporation until a by-law approving the same has been submitted to and has received the assent of the electors qualified to vote on money by-laws. If the electors of a municipal corporation vote to take a supply of electrical power from the Commission, the Council of the municipality may authorize entering into a contract with the Commission without submitting a by-law for the assent of the electors.

"Notwithstanding anything in the Municipal Act or any general or special Act contained, debentures issued or purporting to be issued by a municipal corporation which has entered into a contract with the Commission for a supply of electrical power or energy from the Commission for the purpose of carrying out such contract, or for constructing or equipping works for the development, transmission and distribution of electrical power or energy so supplied, shall not be included in ascertaining the limits of the borrowing powers of the corporation as prescribed by the Municipal Act or such other general or special Acts." 7 Geo. V, c. 20, s. 6.

The municipality, in addition to the price per horsepower payable, agrees to pay the following:

- (1) Interest at the rate of 4% per annum upon money expended by the Commission.
- (2) An annual sum sufficient to form in thirty years, with interest at 4%, a sinking fund for the repayment of the advances made by Ontario.
- (3) Line losses.
- (4) The cost of operating, supervising, maintaining, repairing, renewing and insuring works.
- (5) Such a sum not to exceed \$15,000 per annum to be paid to the Chairman and other members of the Commission as remuneration for their services in addition to any sum payable

to them out of the Consolidated Revenue Fund.

- (6) Such sums as may be appropriated for the establishment and support of any fund established by the Commission for the payment of superannuation or retiring allowances and sick benefits.
- (7) Such sums as the Lieutenant-Governor in Council may direct to cover the difference between 4% interest charged on the money so advanced on capital account, advances for working capital and all charges and expenses of providing such money.

"Notwithstanding anything in the Power Commission Act contained, the municipal corporation which has entered into or shall hereafter enter into a contract with the Commission for a supply of power, may be relieved by the Commission from the payment of any sums on account of the sinking fund for the first five years . . . and the amounts required from such corporation on sinking fund account shall be payable during the then next ensuing thirty years." 7 Geo. V, c. 20, s. 13.

"The Commission may from time to time during the first three years after any municipality shall first begin to take power from the Commission extend the time for payment of the sums payable by any municipality or any part thereof, and such municipality shall pay to the Commission interest on the amount which may be in arrear or for the payment for which time is extended until the payment thereof, at such a rate not exceeding 7% per annum, as the Commission may determine." 8 Geo. V, c. 14, s. 12.

A municipal corporation having a contract with the Commission shall not issue debentures for extension or improvement without the approval of the Commission.

Any one or more of the rate-payers in a municipality which has not entered into a contract with the Commission may apply to the Corporation, requesting it to obtain from the Commission a supply of electrical power or energy for the use of such rate-payer, and the Commission shall furnish to the corporation an estimate as to the maximum cost per horsepower at which power will be supplied by the Commission and an estimate of the cost of constructing and providing a transmission line for the delivery of the power, and the council shall, at a special meeting called for the purpose and with the consent of the applicants or such of them as shall signify their desire to enter into a contract for the supply of electrical power by the Commission, consider the statement and estimates furnished by the Commission. "The corporation without submitting the same to a vote of the electors and without any of the other formalities required in the case of a by-law passed under Part I, may pass a by-law for entering into a contract with the Commission for the supply of electrical power or energy required by the application and may enter into a contract with the Commission for that purpose."

The by-laws may provide for the issue of de-

bentures of the corporation to meet the cost of construction and installation of the works and the levying of a special tax for the payment of principal and interest in a manner provided by the Municipal Act.

The amount payable by the applicants each year shall be sufficient to recoup the municipality. The amount required to pay the principal and interest of any debentures issued and to meet the annual payments required to be made to the Commission, and, in default of payment, any amount due to the corporation, may be entered on the Collector's roll and collected in the same manner as other taxes.

The corporation of every city and town shall, if entering into a contract with the Commission, establish a Commission for the control and management of all works undertaken by the corporation for the distribution of electrical power, and, in a city of over 100,000 people, this Commission shall consist of three members, one of whom shall be appointed by the municipal council of this city, one shall be appointed by the Hydro-Electric Power Commission and the third shall be the mayor of the city.

By the Hydro-Electric Railway Act:

A municipal corporation is authorized to enter into an agreement with the Hydro-Electric Power Commission for the construction, equipment and operation of an electric railroad to be operated by electrical power or energy supplied by the Commission. This agreement requires the municipality to bear its share of the cost of constructing, operating, maintaining and renewing the railway, to issue debentures, for the construction thereof, maturing in fifty years from the date of issue, to make no agreement or arrangements with any other railway or transportation company without the written consent of the Commission, and to pass such by-laws as may be required by the Commission for fully effectuating the objects of this agreement.

The council of every corporation entering into an agreement with the Commission shall annually raise and pay over to the Commission its proportion of such sums as may be required by it for working capital, or to meet any deficit in the cost of maintenance and operation of the railway. The municipality shall deposit with the Commission debentures to the amounts respectively apportioned as its share of the cost of the construction and equipment of the railway, which debentures shall be held by the Commission as collateral security for the bonds issued by the Commission.

It shall not be necessary to obtain the assent of the electors to any by-laws for the issue of debentures under this Section.

"Notwithstanding anything in the Municipal Act or in any other general or special Act contained, debentures issued or purporting to be issued by a municipal corporation under the authority of the Hydro-Electric Railway Act 1914 for the purpose of carrying out any contract entered into with the Commission under the authority of the said Act, shall not be included in ascertaining the limit of the

borrowing powers of the corporation as prescribed by the Municipal Act or any other general or special Act." 7 Geo. V, c. 27, s. 32.

Where a by-law approving the contract with the Commission is defeated in some municipalities and carried in others, the remaining municipalities are permitted to contract with the Commission for the construction of the railroad, the cost of operation of which is apportioned between those municipalities entering into such contracts.

A municipal corporation shall not enter into agreements as to bonuses, licenses or other inducements to any railway or transportation company without the written consent of the Commission, and the municipal corporation further may not sell or dispose of any steam railway, electrical railway or street railway owned by it until the assent of the municipal electors shall have been given.

By the Public Utilities Act:

By this Act a municipal corporation may manufacture, procure, produce and supply for its own use, and the use of the inhabitants of the municipality, any public utility for any purpose for which the same may be used.

The corporation is given the right to expropriate land which the municipality may require in taking over such utilities and to enter on private property with the consent of the owner.

No action shall be brought against any person or anything done in the pursuance of this Act, except within six months next after the act committed, or in case there is a continuation of damages within one year after the original cause of action arose.

"Whereas a Commission is established which has the control and management of works constructed for the distribution of electrical power or energy supplied by the Hydro-Electric Power Commission of Ontario, the salary or other remuneration of the

Commissioners so far as the same is chargeable to such works shall be subject to the approval of the Hydro-Electric Power Commission of Ontario." 7 Geo. V, c. 47, s. 3.

By the Municipal Act:

By Section 288 the whole debt and the debentures to be issued by a municipality therefore shall be made payable within thirty years if the debt is a bonus in aid of a railway or for railways, electric light, heat or power works or water privileges or lands used in connection therewith.

Where the principal of a debt is made payable at a fixed date, the municipality must annually raise a specific sum sufficient to pay the interest on the debentures and another specific sum which, with the estimated interest at a rate not exceeding 4% capitalized yearly, will be sufficient to pay the principal of the debentures when it becomes due.

By the Municipal Electric Contracts Act:

A Municipal Corporation shall not enter into or renew any contract for the supply of electrical power or energy to the corporation or to the inhabitants thereof, nor grant any franchise or any renewal of a franchise for the supply and distribution of electrical power or energy within the municipality, until a by-law setting forth the terms and conditions of such a contract or franchise has been first submitted to and has received the assent of the municipal electors in the manner provided by the Municipal Act.

The foregoing laws clearly bring out that the Hydro-Electric Power Commission of Ontario is legally empowered to act as a public service commission, an engineering company, a public utility company, a holding company, a construction company, a banker, a manufacturer, a jobber and an underwriter's inspector.

ORGANIZATION OF THE COMMISSIONS

Ontario ✓

The Hydro-Electric Power Commission of Ontario is regulatory and executive. Its powers have been briefly outlined in the last paragraph of Section 4 preceding.

California

The powers of the California Railroad Commission are solely regulatory. The Commission has authority in respect to regulation over steam railroads, auto stage lines, jitney buses, auto trucks, express companies, telegraph and telephone companies, water companies, both domestic and irrigation, pipe lines, electric plants and systems, gas companies, heating companies, warehouse and food storage enterprises, sleeping, dining, despatch, freight and refrigerator car lines, ships and shipping on inland waters or on the high seas between California points, and wharfingers.

Quebec

The Quebec Public Service Commission consists of three members, appointed by the Lieutenant Governor in Council. Each Commissioner holds office for ten years from date of appointment, but at any time may be removed for cause by the Lieutenant Governor in Council.

The Commission has jurisdiction over all Service Corporations, other than municipal or school corporation, firm, person, or association of persons, subject to the legislative authority of Quebec, that owns, operates or manages or controls any system, works, plant or equipment for the conveyance of telegraph or telephone messages, or for the conveyance of passengers, or goods, or work, or railway, or tramway, or upon any lake, river, or stream for the production, transmission, delivery or sale of heat, light, water or power.

CONSTITUTIONAL LIMITATIONS

Ontario

Ontario has no basic constitutional law. The Provincial Parliament, or the Lieutenant Governor in Council during Parliamentary recess, may do many things not allowed to a State legislature. The Hydro-Electric Power Commission is practically immune from legal action, as the law states: "No action shall be brought against the Commission or against any member thereof for anything done or omitted in the exercise of his office without the consent of the Attorney General for Ontario."

To date the Attorney General has not granted permission to bring suit against the Commission.

California

The intent of the California Railroad Commission law is clear and specific in that it grants the fullest possible authority to the Commission for regulatory purposes only. California has a formal written constitution which neither any law passed by legislature nor any law passed by public vote may override, and California courts, therefore, may decide whether any law granting authority to the Commission, or any practice of the Commission, conflicts with the general constitutional rights.

Quebec

Quebec has no basic Constitutional law. The Commission has wide powers, but not as wide as those of the Ontario Power Commission. In case the Attorney General, a municipality, or any party interested makes complaint to the Commission that any Public Service, Municipal Corporation, Company, or person has lawfully, or unlawfully, failed to do something relating to a matter over which the Commission has jurisdiction, the Commission is empowered, after hearing such evidence as it may think fit to require, to make such disposal of the case as circumstances demand. The decision of the Commission, upon any question of fact, within its jurisdiction is final. Like the Ontario Hydro-Electric Power Commission, neither the Commission, nor any of its officers or employees shall be personally liable for anything done by it, or by him, in the exercise of its or his functions.

INVESTMENT

Ontario

The Hydro-Electric Power Commission has at different times made valuations of properties owned by it or which were being considered for purchase, but it exercises no authority over the valuation of the privately managed corporation or issuance of securities by them. The Power Commission Act gives the Commission authority over the issuance of securities for distribution works, and no securities may be issued by the municipalities for the construction of such works without the approval of the Commission.

California

The Railroad Commission of California makes valuations of property on an historical basis in order to determine the actual investment in properties useful in the public service, and from the date of such valuation additional actual investments, including overhead and useful properties, are from time to time added. The Railroad Commission passes upon the character of each such addition, and investigates and authorizes or disapproves each issue of bonds, stock or other security, and fixes the price and terms upon which each may be sold. The Commission is given and exercises this power, in order that it may have before it at all times the actual investment in used and useful property of each enterprise under regulation.

Quebec

There is nothing specifically stated in the Act concerning investment.

SALE, PURCHASE, OR LEASE OF A PUBLIC UTILITY

Ontario

The Commission exercises no authority over the sale, purchase or lease of properties of private corporations. Where a corporation is to purchase, lease or sell a property, the approval of the Lieutenant Governor in Council must be obtained, but the law does not require that the Commission prove that the purchase or lease of the property is for the benefit of the public service.

California

The full authorization of the Railroad Commission is necessary for the sale, purchase or lease of a public utility property. A petition must be filed with the Commission showing in detail the reasons "and all facts warranting and showing that it is for the benefit of the public service." The petition must be accompanied with a detailed description of the property with original cost and present value, together with copies of legal documents and contracts.

Quebec

There is nothing in the Act which specifically pertains to this matter.

NEW CONSTRUCTION

Ontario

The Hydro-Electric Power Commission exercises no authority as to the general construction of companies privately owned, with the exception that by law it may order them to place wires underground or to make certain alterations in their plants and works so as to conform with the Commission's rulings. New construction undertaken by the Hydro-Electric Power Commission is subject to the approval of the Lieutenant Governor in Council. The Commission does, however, have authority over the construction undertaken by the municipalities in the installation or extension of their distribution works.

California

For new construction, utility companies in California must obtain from the Railroad Commission a certificate showing "that the present or future public convenience and necessity requires or will require such construction." Furthermore the Commission supervises the issuance of all securities required to pay the cost of such construction.

Quebec

The Quebec Public Service Commission has the right to make certain rules and regulations as to the manner of constructing. It is given no authority or supervision over the capital expenditures for such construction.

SUPERVISION OF RATES

Ontario

The Hydro-Electric Power Commission acts as a regulatory body in cases of dispute as to rates between the municipalities or companies served by them and itself, and also between individual customers and the municipalities serving them with power. It does not act as a regulatory body in the matter of rate disputes between a customer and a public service company privately owned.

The Commission fixes the cost of power wholesaled to the municipalities and to certain large industrial or power companies, and it further fixes the individual rates to the customers in the municipalities to whom it sells power. The practice of rate-making which has been established by the Hydro-Electric Power Commission is radically different from that in use in California. Each municipality or company buying power from the Commission first pays its proportion of the generating expense, to which is added the transmission cost from the generating station to the municipality or company to which the power is sold. This system of rate-making gives an actual wholesale cost of power to the municipalities varying over exceedingly wide limits.

The law under which the Hydro-Electric Power Commission operates states that the power must be sold at cost, and it makes no allowance as to whether the charge to the municipality or company is fair or unfair. The Commission under the law is permitted to contract with private companies for the sale of a portion of the power, and the profits or the losses from such business are either credited to or charged against the municipalities. The cost of power furnished by the Hydro-Electric Power Commission recognizes taxes only to the extent of those against land, which are practically negligible.

California

The California Railroad Commission fixes all rates. Rates are based upon cost, including:

- (a) Cost of money.
- (b) Taxes, fees, etc.
- (c) Operating expenses.

The cost of money is presumed to allow the company a fair return upon its actual investment, such as will induce the flow of capital into a necessary and wisely managed industry, and in the amounts necessary for the development of the State. The Commission, however, may impose a limitation in that if based upon cost and the resulting rates are not fair, the company is not entitled to its full return upon the investment.

The California Railroad Commission fixes the individual rates for each community and for each class of business. The theory employed by the Commission implies an interconnected power system with all sources of power fed into the system and all uses supplied from it. No attempt is made to allocate the kilowatt hours used by a particular source, or to base the cost to the ultimate consumer upon the cost of producing power at that source. Power from the interconnected system is considered at the average cost of all of the generating plants, including the cost of transmission. This rate practice gives wholesale power at approximately the same cost at each sub-station upon a system and individual consumers' rates vary but little from each other in the different localities.

Quebec

The Commission upon complaint has the authority to hear rate cases and to render a decision.

DUTIES OF THE COMMISSION

Ontario

The duties of the Hydro-Electric Power Commission of Ontario have been discussed in detail in Section 1 and 2 preceding. They may be summarized by the following quotation in the Hydro-Electric Power Act as follows:

"The Commission shall have the exclusive jurisdiction as to all matters in respect of which authority is by Act conferred upon it, and nothing done by the Commission within its jurisdiction shall be open to question or review in any action or proceeding or by any court."

California

The duties of the California Railroad Commission are defined as to their intent by Section 31 from the California law as follows:

"Section 31. The Railroad Commission is hereby invested with power and jurisdiction to supervise and regulate every public utility in that State, and to do all things whether herein specifically designated or in addition thereto which are necessary and convenient in the exercise of such power and jurisdiction."

The decisions of the California Commission are subject to review by the courts in respect to the constitutionality and justice of their acts.

Quebec

The Quebec Public Service Commission has jurisdiction in all matters within the jurisdiction of the Railway Committee, the transportation of goods by tramway companies, contests regarding rates for public service, placing of rails on public roads, for certain contests between public utilities and municipal administrations, and expropriation.

EXTENSIONS

Ontario

The Hydro-Electric Power Commission may make extensions in its own facilities and it may order the municipalities purchasing power from the Commission to make certain improvements, such as placing wires underground, etc. The Commission further has the right to "regulate equipment in electrical works owned by either municipalities or by private corporations."

California

The California Railroad Commission has authority to order additions, extensions, repairs, changes, etc., when in the judgment of the Commission such changes are needed for proper service. The Commission may require the joint action of two or more public utilities for such improvements.

Quebec

Upon the complaint of any municipality or other interested party that a public service utility doing business in such municipality fails to extend its service, the Commission, after hearing the parties and their witnesses, and making such inquiry into the matter as seems equitable, may order the extension and state the conditions under which same shall be done, including the cost of all necessary works, which it may apportion between the public utility and the municipality, in any manner it deems advisable.

RIGHT OF EMINENT DOMAIN

Ontario

The Hydro-Electric Power Commission may expropriate property for its own use or for the use of a municipality whether or not the property is devoted to public use. The law does not give the Commission authority over proceedings brought by private companies, nor does the Commission have final authority over the price in any proceeding. The price to be paid for expropriated property is determined by an arbitration proceeding, the conduct of which is governed by the Provincial laws. However, the Commission does have authority to conduct arbitration proceedings differently from this law in that it may appoint a sole arbitrator rather than the three arbitrators called for in the basic law.

California

California Railroad Commission has authority covering the acquirement of property for public purposes through condemnation. The process of condemning property for public use in California is carried out by court action and the function of the California Commission in such proceedings is to determine the price to be paid for the property. Two classes of condemnation cases appear in California; in one private property is sought to be taken by a public utility, and in the other the property of a public utility is sought to be taken by a municipality or other political sub-division. The Railroad Commission is instructed to find a just compensation to be paid for the property to be taken, stating this in a single sum and stating separately, however, also in a single sum, the severance damage for property not taken. The California law provides: "The finding of the Commission on the question of the necessity for the taking and the finding, fixing the just compensation to be paid for any property or interest in or to property under the provisions of this subsection shall be final and shall not be subject to modification, alteration, reversal or review by any court of this State."

The actual taking of property is consummated through the court, but the court receives no evidence as to value other than that furnished by the Commission's finding.

Quebec

The Quebec Public Service Commission is given authority over the proceedings for the expropriation of property for municipal purposes, and the Commission may forcibly or otherwise enter upon, seize or take possession of the whole or part of movable or immovable property, or such public utility, together with the books and offices thereof, and may, until such order has been enforced, assume or take over all or any of the powers, duties, rights or functions of the directors and officers of the public utility, in all respects, including the employment and dismissal of officers and employees thereof, for such time as the Commission continues to direct such management.

5. A Comparison of the Powers Granted to the Hydro-Electric Power Commission of Ontario to those for the California Railroad Commission and the Quebec Public Service Commission

General:

For the States, the California Railroad Commission has been selected for comparison with the Hydro-Electric Power Commission of Ontario for the reason that it may be considered as a model for the best type of public service commission functioning within the United States.

The Quebec Public Service Commission was selected for the reason that in the Province of Quebec nearly all electric utility development has been undertaken and is being operated by private capital under the jurisdiction of this Commission.

PHYSICAL ASSETS

California

Physical property is reported on the basis of actual cost in respect to investments made under the supervision of the Railroad Commission. For investments made prior to the formation of the Railroad Commission the equivalent cash investment is determined by an appraisal of the property on the historical basis.

The physical assets are divided into the following sub-accounts:

(a) *Production investment.* This includes investments of the hydro-electric, steam, electric and other power generating sources, and for each class of producing plant the costs are reported in detail with regard to the several elements going to make up the total. Real estate is included, as are water rights and franchises to the extent of actual cash payments made to governmental agencies therefor.

(b) *Transmission cost.* The transmission investment is inclusive of transmission lines and sub-stations, the cost for which is detailed by items, and so summarized that the total costs for each important unit of line and sub-station may be identified.

(c) *Local distribution investment.* The local distribution investment is itemized by the class of property involved, and is further subdivided geographically by districts.

(d) *General investments.* This item includes all investments not specifically applicable to any of the three preceding items.

(e) *Construction work in progress.* Under this item is included all of the monies spent on new construction up to the time when the physical structure begins to render service to consumers, the fixed charges for which should then be properly deducted from revenue. The account is subdivided geographically, and as to classes of property.

By reason of the method employed by the Commission in proportioning the cost of power to the several municipalities which it serves, it is necessary to have very detailed costs, both as to investments and the annual operating cost for each element entering into the system. The various elements of cost must be minutely subdivided in order to arrive at the proportion of investment and the proportionate operating cost for each customer. The investments and operating costs published by the Hydro-Electric Power Commission are shown in such a manner as to conform with the requirements of the law as set forth in the Power Commission Act. Their presentation, however, does not admit of easily determining whether or not the management has been efficient in the construction and operating of the various cost elements of the system. However, in the detail

Ontario

The physical assets of the Hydro-Electric Power Commission and of the municipalities contracting therewith are both given.

The physical assets of the Commission given in Volume I of their Annual Report do not show any logical arrangement as to subdivision into the several elements of cost. For some of the systems the physical assets as reported, power plants and transmission systems are separated, while in others they are merged. In no instance is the transmission system subdivided so as to show separately the value of the transmission lines from that of sub-stations. For certain properties such as the Essex County System, Thorold System and the Ontario Power Company, either the purchase price or the value of the Commission's bonds paid for the property are included in assets rather than the actual cash value of the physical facilities for these properties.

(a) *Production Investment.* In most instances the investments made in power plants by the Commission are not kept separately from transmission and sub-station investments, as a result of which it is impossible from their published reports to ascertain the elements of their investments. Where production investments are shown they are not subdivided, but are given in total only.

(b) *Transmission Costs.* Transmission costs can be ascertained only for those systems for which the Commission owns no production facilities, and they are given only in total.

(c) *Local distribution investment.* The Commission in reporting on the physical assets of the municipalities as contained in statement "A" of Volume II of each Annual Report, subdivides the distributing system into two general accounts, namely, plant and other assets. The plant account is subdivided into eleven sub-accounts from which the value of the several elements of the property may be determined.

(d) *General investments.* The Commission sets forth its General Investment in its statement of assets, and included therein such items as office service, garage and storehouse buildings, office furniture and equipment, automobile trucks, inventories, etc., all of which cannot be specifically assigned to any one of the preceding items.

(e) *Construction work in progress.* For the Commission's system certain items of the construction work in progress are detailed among its assets. These for 1920, including such items as the power development on the Nipigon River, the Niagara power development works and certain radial railway construction in progress. However, unless one is thoroughly familiar with the details of the construction then in progress, and with the methods of keeping accounts it would be impossible to segregate these

PHYSICAL ASSETS (Continued)

California

Other assets. Under other assets is included such items as sinking and other special funds; investment in system corporations, investments in the securities of other corporations, deferred charges, current assets, etc.

Ontario

items from capital assets in property then operating, as these two classes of investment are frequently added together to make a system total. Thus for the Thunder Bay System, physical assets as of October 31, 1920, are shown as the total of the Nipigon Development then under construction, and of the investments in operating transmission lines and sub-stations by which Port Arthur was at that time receiving power from the Kaministiquia Power Company.

For the municipalities receiving hydro service there is contained an account among the assets of miscellaneous construction expenses, which includes the construction in progress, the fixed charges against which could not properly be deducted from revenue.

(f) *Other assets.* For the Commission's operations included among other items are such items as sinking fund, investments and other companies, cash accounts receivable, balance due by municipalities for power supply, deficit on rural lines and insurance unexpired.

For the municipalities receiving power from the hydro system there is listed among the other items such items as cash securities and investments, accounts receivable, investments, sinking fund, equity in the hydro system, equity in rural lines and hydro operating account.

LIABILITIES

California

The California Companies must report separately each item of stock, bonds, notes, debentures, etc., outstanding. Funded debt items are required to be reported so that the rate of interest, the interest date, provisions as to call, the authorized amount of issue, the amount reserved for prior lien, the amount exchanged for other issues, the amounts deposited and held alive under other mortgages, the amounts retired and the amounts outstanding in the hands of the public must be shown.

In addition to funded debt, current liabilities, reserves and surplus are shown in the liability account.

Ontario

The liabilities of the Hydro-Electric Power Commission are shown in the form of the cash advances from the provincial treasury, cash advances from banks, the debentures of the Hydro-Electric Power Commission issued for the purchase of the securities of private companies, and the debentures of private companies assumed. The amounts are given only in total, with no detail as to interest date, date of call or any other pertinent information.

For the Ontario Power Company only the debentures issued by the Hydro-Electric Power Commission for the purchase of the stock of the Ontario Power Company are considered as a liability.

In addition to the funded debt, the balance sheet of the Hydro-Electric Power Commission shows as liabilities such items as outstanding claims and awards, surplus, balance due to municipalities in excess of the cost of power supplied to them, reserves for sinking fund, reserves for renewals, reserves for contingencies and other surplus.

OPERATING STATISTICS

California

DISPOSAL OF OUTPUT

The disposal of the output of the power plants of an electric utility system in California is shown in the following manner:

Transmitted from Generating Stations.

Hydro Plants, etc.

Steam Plants

Total

Electric Energy from Other Sources.

Power Exchange Received.

Total

Power Exchange Delivered.

Total Transmitted.

Less Transmission Loss

Received at Sub Station

Less Sub-Station Loss.

Distributed.

Sold Municipal Street Lighting—Arc.

Sold Municipal Street Lighting—Incandescent.

Sold Municipal Street Lighting—Miscellaneous.

Sold Commercial Lighting —Flat.

Sold Commercial Lighting —Metered.

Sold Commercial Lighting —Comb. rate.

Ontario

DISPOSAL OF OUTPUT.

The disposal of the output of the power plants or the purchased power for the Hydro-Electric Power Commission is shown by the average horsepower purchased by each municipality, or by the total of the companies contracting directly with the Hydro-Electric Power Commission. This does not correspond with the average horsepower generated and purchased which is not set forth in the annual reports of the Commission, owing to the diversity between the sum of the individual demands of the customers as against the resulting demand placed upon the source of power.

The energy output is given only for the Ontario Power Company plus purchased power for the Niagara System. No attempt is made to analyze this energy output in respect to the amount sold directly to the Niagara System and that sold to direct customers of the Ontario Power Company.

It is impossible from the records of the annual reports to trace the relation between power or energy sold and power or energy purchased; in fact, meters are not installed to such an extent that such information can be determined.

MURRAY AND FLOOD REPORT

OPERATING STATISTICS (Continued)

California

Ontario

Current Furnished Free.

Used by Company.

Total Lighting.

Accounted for—Power

Sold Municipal Power.

Sold Commercial Power—Flat.

Sold Commercial Power—Metered.

Sold Commercial Power—Comb. Rate.

Sold Railway Power.

Sold Other Electric Corporations.

Current Furnished Free.

Used by Company.

Total.

Total Accounted for Light and Power.

Unaccounted for.

Per Cent. Unaccounted for.

OPERATING EXPENSES

California

Ontario

The operating expenses of electric utility systems reporting to the California Railroad Commission are set up in the following manner:

Operating expenses as set up in the Annual Report of the Commission show:

Production and Transmission Expenses.

Hydro-Electric Plants.

This is subdivided into ten items.

Steam Plants.

This is subdivided into twelve items.

Transmission Sub-Stations.

This is subdivided into five items.

Transmission Lines.

This is subdivided into twelve items.

Distribution Expenses.

This is subdivided into twenty-seven items.

Commercial Expenses—Local.

This is subdivided into eleven items.

General Expenses—Local.

This is subdivided into eight items.

General and Miscellaneous Expenses—General.

This is subdivided into twenty-one items.

(a) The cost of power to the Commission.

(b) The total cost for operating, maintaining and administering the system.

(c) Interest.

(d) Renewals.

(e) Contingencies.

(f) Sinking fund.

These costs are prorated to each of the municipalities.

For all systems where the power is generated by the Commission itself production cost is not separated from the other costs, and only totals for the entire system are available in the reports.

For the distribution systems owned by the municipalities the Commission requires the following subdivisions of operating accounts.

(a) Power purchased.

(b) Sub-station operation.

(c) Sub-station maintenance.

(d) Distribution system, operation and maintenance.

(e) Line transformer maintenance.

(f) Meter maintenance.

(g) Consumers premises expense.

(h) Street light system operation and maintenance.

(i) Promotion of business.

(j) Billing and accounting.

(k) General office salaries and expenses.

(l) Undisputed expenses.

(m) Interest and debenture payments.

(n) Miscellaneous expenses.

(o) Depreciation charge.

The operations of the Ontario Power Company are considered to be entirely separate from the operation of any system, and while the Commission owns the entire capital stock of this corporation, it charges the Niagara system for the power as if purchased, and does not show any of the elements of cost in its annual reports.

For the Central Ontario system no item of expense is given, the only entry being that of an "operating deficit" in the annual balance sheet.

costs kept by the Commission, but not published, the form of cost keeping used is very similar to the standardization system of accounts used by the National Electric Light Association, so that should the executives of the Commission desire to know with what efficiency any element is being constructed or operated, such information can be ascertained.

The California Railway Commission, on the other hand, provides for a system of costs similar in structure to that advocated by the National Electric Light Association and to that which has been generally adopted by the several Commissions throughout the United States. From this system of accounts, it is at once possible to determine the efficiency of management.

In comparing these two accounting systems it must be borne in mind that the comments on the Ontario method are based on the statistics published in annual reports, and not upon the details available to the Commission. In other words, the comparison is upon a basis of the information directly available to the public.

Comparison cannot be made for the Province of Quebec as the Public Service Commission of that Province has no authority to supervise the methods of accounting of the electric utilities.

6. A Comparison of the Accounts Published by the Hydro-Electric Power Commission of Ontario to those for the California Railway Commission

GENERAL: The Hydro-Electric Power Commission of Ontario is empowered by the Power Commission Act to set up a standard system of accounting, both for its own operations and for those of the municipalities owning distributing systems to which it disposes of its output.

SECTION D—(PART II)

THE COST OF POWER TO THE PEOPLE OF ONTARIO, SERVED BY THE HYDRO-ELECTRIC POWER COMMISSION

Strategic Position of Ontario with Respect to the Availability of Cheap Power

While the Province of Ontario does not possess any known supplies of coal, it is unusually situated in respect to the availability of water powers, and particularly with regards to the location of the large hydro-electric developments at Niagara Falls and the potential hydro-electric developments on the St. Lawrence River, both of which are within reasonable transmission distances of the principal industrial centres in the Province.

When considering the cost of power to the people of Ontario, not only must the availability of water power be kept in mind, but, further, the cheapness of the development for water power must not be overlooked.

The situation with regards to the main supply of central station power for the Province is probably best brought out by the statement of Sir Adam Beck before the Committee on Water Power of the House of Representatives at the Sixty-fifth Congress of the United States on April 15th, 1918 as follows:

Mr. Hamilton: "So I infer from your statement that your nearness to Niagara as a source of power is of no special advantage to you?"

Sir Adam Beck: "It is an enormous advantage, because we sell it around Niagara at \$11.50 per horsepower."

Mr. Hamilton: "Now why can you buy it so cheap?"

Sir Adam Beck: "Because it is cheap at the point of development."

Mr. Hamilton: "Isn't that the whole gist of it?"

Sir Adam Beck: "Yes. The large users, the large electro-chemical works and large steel works will locate at Niagara Falls. But then that is not on why we

should not have the City of London, 125 miles away, using 10,000 horsepower at a price one-half the cost of electricity generated by coal. And half a loaf is better than no loaf."

Mr. Hamilton: "Very well, we are back to the original proposition. In other words, if Niagara Falls were not there at all, what would be the effect on Ontario?"

Sir Adam Beck: "We would be using American coal."

Mr. Hamilton: "Then you are favored geographically because of your nearness to Niagara Falls?"

Sir Adam Beck: "Yes, because we have Niagara Falls in the Province of Ontario, or half of it."

There is but a very small proportion of the total capacity in the central electric sections of the Province of Ontario which are using fuel for the generation of power. About 96% of all such capacity is in hydro-electric plants. Excluding the Central Ontario System, the Hydro-Electric Power Commission supplies to the municipalities on the Niagara System, more than 88% of all the power sold by it, while, based on the total kilowatt hour output of the Hydro-Electric Power Commission, more than 87% of all of the energy generated and purchased by the Commission is produced by plants at Niagara Falls, which, because of their originally low construction costs, should be classed among those power developments having the lowest cost for power generation in the entire world.

The Structure of the Governmental Electric Utilities in the Province of Ontario

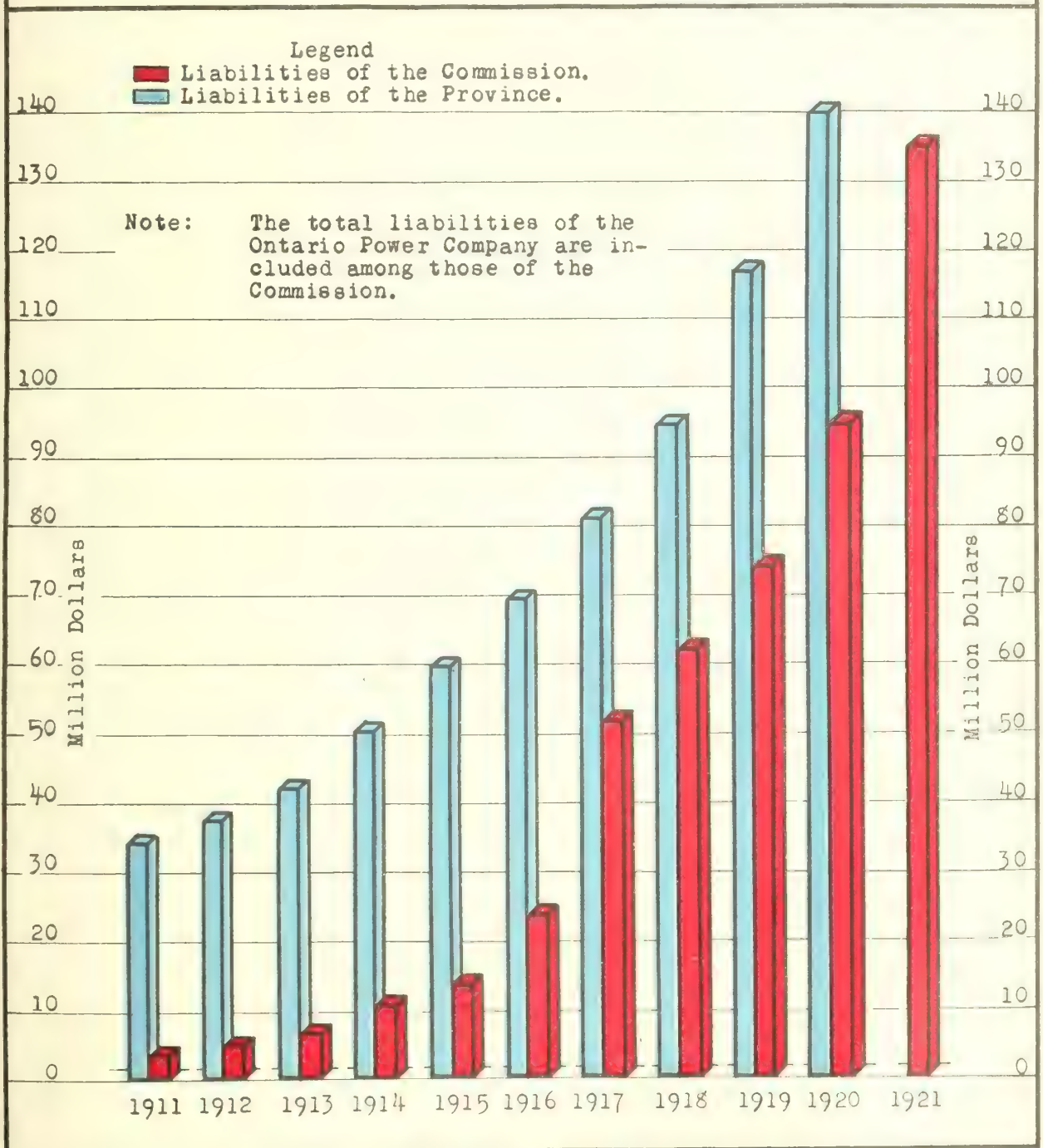
The governmental electric utilities in Ontario may be divided into three distinct classes:

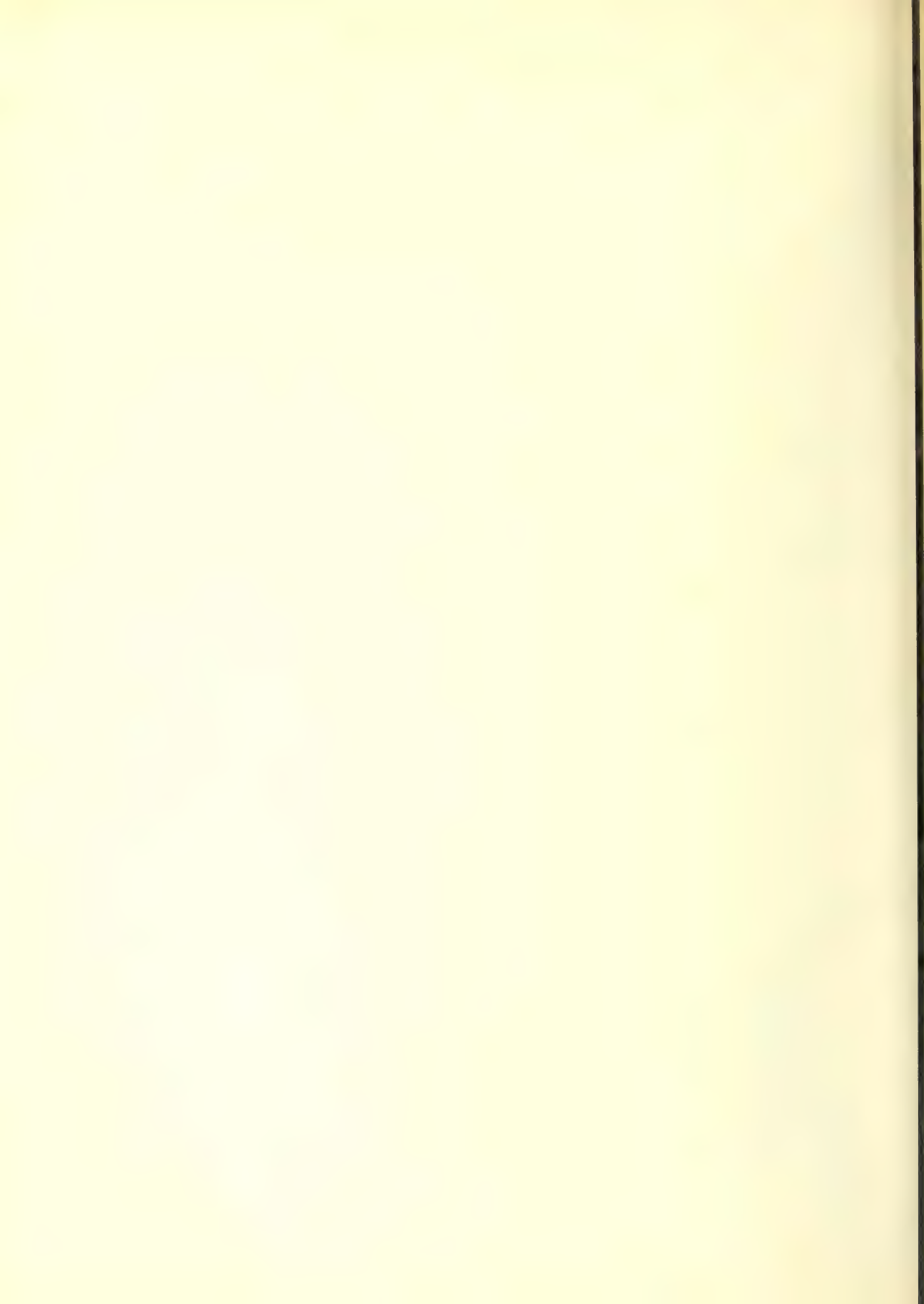
First: Those constructed and operated by the Hydro-Electric Power Commission of Ontario on behalf of the municipalities. This group consists principally of the generating plants, transmission lines, and the principal sub-stations by which power is pro-

Figure 8

Relation of the liabilities of the Hydro
Electric Power Commission to the
liabilities of the Province
of Ontario.

Note: The liabilities of the Central Ontario Power Company
and the Ontario Power Company are included in the
liabilities of the Commission.





duced and transmitted for sale to the municipalities. These facilities, while owned by the municipalities, are held in trust by the Hydro-Electric Power Commission until at least such time as the municipalities reimburse the Province of Ontario for all of the expenditures of capital, with interest paid thereon.

Second: The distribution system, located within the municipalities themselves, which are directly constructed and operated by the municipalities through the issuance of Municipal Debentures. The Province of Ontario and the Hydro-Electric Power Commission assume no financial responsibility in respect to this group of governmental electric utilities.

Third: Complete electric utility systems purchased by the Province of Ontario and operated in trust for it by the Hydro-Electric Power Commission. There is only one such system, namely—the Central Ontario System, which was originally comprised of 22 companies, and was purchased by the Province in 1916. This system includes electric power and light systems, street railways, gas properties and water works.

The Hydro-Electric Power Commission, per se, owns no equity in any of the properties which it operates. It is either a trustee for the municipalities or for the Province, and manages the properties entrusted to its care for the best advantage of these governmental bodies.

Money for the construction of properties and the extensions thereto is obtained by the Hydro-Electric Power Commission principally in two ways—by cash advances from the Provincial Treasurer or by the issuance of Hydro-Electric Power Commission Bonds. In the original Power Commission Act, the Treasurer for the Province could make cash advances to the Hydro-Electric Power Commission only as voted by the Provincial Legislature, and approved by the Lieutenant Governor in Council. Recently, however, this Act has been amended to permit the Provisional Treasurer to advance cash to the Commission should the Provincial Legislature not be in session, and with approval of the Lieutenant Governor in Council. Where the Hydro-Electric Power Commission finds it advantageous to issue its own bonds rather than to accept cash from the Provincial Treasurer, such bonds are guaranteed by the Province of Ontario and become an indirect liability of the Province.

The official auditor appointed by the Province in respect to matters pertaining to the Hydro-Electric Power Commission, Mr. G. T. Clarkson, has stated:

"Monies raised by the province for the purpose of any department of the Government or for the Commission, cannot, under the Audit Act be paid over without a vote of the Legislature and when so voted, they are strictly limited in amount. Under the Acts regulating its power the Commission

has authority to issue bonds and the Treasurer of the Province is empowered, subject to the approval of the Lieutenant Governor in Council to guarantee the same, but no limitations are imposed in the Acts with respect to the aggregate amount of the bonds which the Commission may issue or the Treasurer of the Province guarantee, with the approval of the Lieutenant Governor in Council. As the liability of the Province is the same to all intents and purposes whether it raises monies direct or guarantees bonds of any undertaking, in that it must see that payment of all borrowings or guaranteed bonds be made, it is a matter worthy to be considered as to whether the Legislature should have direct control over all the finances of the Province or the Treasurer of Ontario remain vested with authority to guarantee bonds with the approval of the Lieutenant Governor in Council.

"Now what does this mean? It is a wrong thing. It means that under the old Government which controlled a servile majority of the Legislature, they brought in an Act by which the Legislature gave up that power which British Constitutional rights has given, gave it up to the Council, and the Council gave it up to the Commission."

"It means that the Parliament had given away a right which it should not have given away, and that this cabinet of the old Government in 1919 in August gave to the Commission unlimited power to issue bonds, to commit the Province to financial liabilities, and simply said to the Treasurer, 'Go ahead and spend all they like to issue.' Mr. Chairman, that thing is wrong and must be made right. The Legislature of the Province of Ontario must again assert its right to vote monies.

"And so I say that growing out of this radial enquiry must come a return to sound constitutional practice. In the next session the House must amend the Act so as to remove from the Act the power given the Government to indiscriminately and indefinitely guarantee bonds, and remove from the Government the power to delegate that power to the Commission and restore the power to vote money, as the Hydro estimates, to the hands of the Legislature. That, to my mind, Mr. Chairman, is the real issue. We must see that it is straightened out."

The Hydro-Electric Power Commission also finances its requirements by short term loans from banks, and, in the case of the purchase of certain properties, by assuming the underlying bonds of such properties. For instance, in the purchase of the Ontario Power Company, the Hydro-Electric Power Commission purchased the stock of that Company in exchange for its own bonds to the extent of \$8,000,000, and it assumed all of the

bonded indebtedness of the Ontario Power Company, amounting to more than \$14,000,000.

The Municipal Commissions finance their entire requirements by the issuance of Municipal Debentures, which are generally of the serial type, calling for a complete retirement in about twenty years from the date of issue.

The entire physical structure of the Governmentally owned electric utilities in the Province of Ontario is built on the cash realized by the sale of bonds. Bonds sold by the Province, bonds of the Hydro-Electric Power Commission, the debentures of the municipalities and assumed bonds of the private companies purchased represent not only the entire physical assets of the government electric utilities, but also purchases of water rights, franchises, good-will, contracts and other intangibles. Accordingly the financial structure has no item of equity, and the bond holders are protected entirely by either the credit of the Province or the credit of the municipalities.

In guaranteeing the bonds of the Hydro-Electric Power Commission and in advancing cash for its use, the Province of Ontario is in fact aiding the municipalities to finance the project, as they are the veritable owners of the entire system. As long as rates can be maintained at such a point that the operating expenses can be met, and interest can be paid upon all of the obligations of the Commission, there is but little danger in the plan, but the danger is that should rates have to be increased to such a point that municipalities begin to drop out of the project, the law requires the remaining municipalities to stand the entire cost which would then begin to pyramid.

The advancing of monies for the municipalities in this instance is not the first venture of like kind by the Province. Unfortunately, however, its previous venture was disastrous. This was known as the Municipal Loan Fund, which was organized by Sir Francis Hincks in 1852, and which was financially wound up in 1872 with an arrangement covering the default by the various municipalities of the great bulk of capital as well as of the accrued interest.

The Municipal Loan Fund provided original advances of \$6,409,400, which were later increased to \$11,416,891 by arrears of interest over the twenty-year period, and of this only \$2,386,417 was repaid, leaving a total loss to the Province of \$9,030,474. There were 29 municipalities which took advantage of the Municipal Loan Fund, and of these not one made its full payments. Among them were such municipalities as Brantford, Chatham, Goderich, Guelph, London, Ottawa, Port Hope, Prescott, Simcoe and Stratford, all of which are found among the municipalities now obtaining the same form of advance from the Province for Hydro service. Thus the Province has a very unfortunate precedent facing it as to what might happen from what has happened in the past.

The borrowings of the Hydro-Electric Power Commission of Ontario and the guarantees of the securities issued by the Commission are not a small part

of the Province's total direct and indirect liabilities. The first complete year of the Commission's activities was 1911, at which time its liabilities amounted to \$4,354,800, which was 12.7% of the total direct and indirect liabilities in the Province of Ontario. By 1916 the liabilities of the Commission had grown to be 33.8% of the total direct and indirect liabilities of the Province, but in the following year, due to the purchase of the Ontario Power Company, they jumped to 64.2% and for the years succeeding were: 65.4% in 1918; 63.3% in 1919; 67.9% in 1920.

Between the years of 1911 and 1920 the Provincial liabilities, direct and indirect, had grown 4.1 times while the Hydro-Electric Power Commission's liabilities had grown approximately 22.6 times. The growth of the liabilities of the Province as compared to the Commission is well illustrated in Figure No. 8.

The Provincial Government, having in 1920 about 70% of its total liabilities in investments for electric utilities, has in fact become more of a commercial enterprise than a Government, and upon the success or the failure of that enterprise rests the entire welfare of the people of Ontario.

For municipalities, Municipal Debentures have been increased, in some instances, more than 400% of those issued for general municipal purposes, as is brought out in Section "I" by Table No. 24, so that the entire financial structure of the governing bodies, both Provincial and municipal, within the Province of Ontario, is one dealing with a tremendous business enterprise, rather than with the direct functions of the government.

The Total Investments and Physical Assets in Governmental Electric Utilities in the Province of Ontario

The total investments in government electric utilities in the Province of Ontario operated by the Hydro-Electric Power Commission are found in Volume I of its annual report, and the investments made by the municipalities in distribution systems are found in Volume II of the same document. The investments made by the Hydro-Electric Power Commission and by the Province in electric utilities are recorded for the fiscal year ending October 31st, while the investments made by the municipalities are recorded as of fiscal year ending December 31st, and for this reason it is impossible to obtain from the reports of the Commission the total investments as of a single date.

In Table No. 2 the total investments in physical assets of the governmentally owned electric utilities in the Province of Ontario are given. The investments made by the Hydro-Electric Power Commission, on behalf of the municipalities, at the end of the fiscal year of 1920 totaled \$51,514,183. The investments made by the municipalities on their own behalf totaled \$26,172,894. The investments made by the Province totaled \$11,036,229. The investments made by the municipalities taking power from the Central Ontario System were \$886,473, and the

investments made by the Commission on properties not yet operating were \$31,662,232. These several items total \$121,232,011, which represented the investments of all of the governmental agencies in electric utilities at the end of the fiscal year of 1920.

The items in Table No. 2 are stated as physical assets. This is not entirely correct, the term being used to distinguish the fixed assets from liquid assets rather than as the true physical value of the properties enumerated.

The Hydro-Electric Power Commission, in setting up its assets and liabilities, classes as assets the stock of certain companies which it has purchased, and such stock and purchase price frequently represents, as stated previously, money paid for such intangibles as franchises, water-rights, goodwill, contracts, etc.

TABLE NO. 2

The Total Investments in Physical Assets of the Hydro-Electric Power Commission and of the Province of Ontario and the Municipalities Therein in Electric Utility Systems for 1920.

I. Investments in physical assets by the Hydro-Electric Power Commission on behalf of the Municipalities as of October 31, 1920

OPERATING POWER DEVELOPMENTS:

Ontario Power Company

(a) Plant real estate, distribution station and rights, franchises and good-will	\$21,995,096
(b) Expenditure on construction of third pipe line	3,494,494
(c) Severn System	649,767
(d) Wasdells System	141,760
(e) Eugenia System	979,424
(f) Muskoka System	148,018
(g) Bonnechere River Storage	34,165
(h) Rideau System	748,941

\$28,191,665

Rights of Way	1,482,884
Steel Transmission Lines	4,190,871
Wood Pole Transmission Lines	5,126,933
Unclassified Transmission Lines	2,049,272
Substations	8,204,159
Essex County System	375,516
Thorold System	89,182
Office and Service Buildings	1,209,278
Automobiles and Trucks	196,038
Inventories (construction omitted)	265,864
Inventory (construction O. P. Co.)	93,898
Experimental Farm	38,623

\$51,514,183

II. Investments in physical assets by the Municipalities on their own behalf as of December 31st, 1920

Lands and Buildings	\$2,127,555
Substation Equipment	3,221,405
Distribution System Overhead	8,323,272
Distribution System Underground	1,268,621
Line Transformers	2,467,266
Meters	2,933,742
Street Lighting	1,751,454
Miscellaneous Construction Materials	2,536,936
Steam and Hydraulic Plants	679,800
Old Plants	812,843

Total II..... \$26,172,894

III. Investments in physical assets by the Province of Ontario in the Central Ontario and Nipissing Systems as of October 31, 1920

Power developments, Rights and Steam Plants	\$4,871,825
Transmission Systems	1,757,835
Transformer Stations	1,119,964
Local Utilities (gas, electric, water and electric railway)	2,370,186
Rural Lines	30,812
Pulp Mill and Pulp Wood Areas	454,227
Inventories	431,380

Total III..... \$11,036,229

IV. Investments in physical assets by the Municipalities on their own behalf which are taking power from the Central Ontario system as of December 31st, 1920

Trent System \$886,473

V. Investments in physical assets by the Hydro-Electric Power Commission in behalf of the Municipalities in properties not yet operating as of October 31st, 1920—Reset in bold face

Niagara Power Development Works...	\$26,846,896
Nipigon Development	3,547,732
Electric Railway Construction	1,227,604

Total V..... \$31,622,232

VI. The total investments in electric utilities by Governmental agencies in the Province of Ontario

Total Investments in fixed capital (I-V inclusive) \$121,232,011

Detailed Investments of the Hydro-Electric Power Commission on Behalf of the Municipalities for the Several Systems as of October 31, 1920

The balance sheet contained in the 1920 Annual Report shows the total fixed investment of the Hydro-Electric Power Commission on behalf of municipalities to be \$51,514,183 when the total fixed investment in the Ontario Power Company is added. No attempt is made to include the Central Ontario System in this particular tabulation, for the reason that this system included light and power properties, street railways, gas works, water works and pulp mills, and the segregated investments and operating expenses for these different classes of service have not been published.

Table No. 3 is divided into two main sections, namely, operating and non-operating properties, in order that these may be made to check both with the balance sheet and with the annual adjustment for proportional investment and operating cost to each of the several municipalities.

Of the total investment in operating properties included, that of the Ontario Power Company and the Niagara System, which may well be considered as one unit, forms 88% of the total, and upon the completion of the Queenston Chippawa Development, the amount of capital invested in the Niagara System will become an even greater percentage of the whole. For all systems the power plant investment represents about 55% of all operating capital; transmission lines and right of way, 28%; sub-stations, 15%; miscellaneous items about 1%.

TABLE NO. 3

INVESTMENTS BY THE HYDRO-ELECTRIC POWER COMMISSION IN PHYSICAL ASSETS ON BEHALF
OF THE MUNICIPALITIES BY SYSTEMS AS OF OCTOBER 31ST, 1920
INVESTMENTS IN PHYSICAL ASSETS NOW OPERATING, IN DOLLARS

				Pole Lines	Transmission Lines	Sub- stations	Miscella- neous	Total
Nipigon System	25,187.5			2,527	2,049,272	1,066,861	151,891	28,757,614
Chippawa System (Rural)		1,482,884	4,185,460	2,527		6,138,110		14,304,588
Chippawa System (Urban)								475,665
Chippawa System (Rural)			29,476			55,514		84,990
St. Lawrence System				552,256		179,207		1,381,230
St. Lawrence System, Rural				269,782		273,057		542,839
St. Lawrence System, Urban				20				20
West System				15,890		26,215		321,665
West System, Rural				11,281				11,281
West System, Urban				544,739		171,785		1,695,948
Thunder Bay System				1,694				1,694
Thunder Bay System, Rural				54,313		9,785		212,116
Thunder Bay System, Urban						1,010		1,010
Rideau System				233,602		48,844		1,032,387
Rideau System, Rural	34,165							34,165
Rideau System, Urban							375,516	375,516
Office and Service Buildings							1,197,288	1,197,288
Accumulators and Transformers							194,187	194,187
Inventories (Maintenance)							221,712	221,712
Losses (Depreciation)							38,623	38,623
Total	28,191,665	1,482,884	4,185,460	4,824,652	2,049,272	7,971,388	2,179,217	50,884,538
Investments in physical assets under construction exclusive of the Nipigon and Chippawa developments and Hydro- Electric Railways								
Niagara System			5,411	25,680		157,722		188,763
Thunder Bay System						35,568		35,568
St. Lawrence System						43		43
St. Lawrence System, Rural				93,930		4,344		98,274
Eugenia System				182,721		35,094		217,815
Total			5,411	302,281		232,771		540,463
Summarization of operating and non-operating investments	28,191,665	1,482,884	4,185,460	4,824,652	2,049,272	7,971,388	2,179,217	50,884,538
Operating			5,411	302,281		232,771		540,463
Thorold System								89,182
Grand Total	28,191,665	1,482,884	4,190,871	5,126,933	2,049,272	8,204,159	2,179,217	51,514,183

The Commission, when receiving money from the Province, annually submits estimates as to the amounts it will require for the specific systems. There has been considerable discussion as to the legality of the Commission diverting funds received for one purpose to another purpose, and Mr. G. T. Clarkson, the Auditor employed by the Province, with respect to the Hydro-Electric Power Commission matter, states in his report for the fiscal year of 1919:

"It is apparent that the members of the Commission . . . of themselves . . . were not fully seized of the extents by which appropriations were being exceeded or monies being expended for purposes other than those for which appropriations had been asked. With the matter drawn to their attention steps have been taken to keep expenditures within appropriations; at the same time it is recognized that if contingencies arise or work not anticipated or looked for, has to be done in any period, some basis must be arrived at, and under a general al-

lowance . . . specified in amount . . . can be made available to the Commission so as to obviate embarrassment and delay and permit it to continue administration of the undertakings in its charge in a practical manner. Such an allowance could be voted by the Legislature subject to payment of it to the Commission from time to time as required and with the approval of the Lieutenant Governor in Council."

This question has been brought up again by Mr. Clarkson in his report for the fiscal year of 1920, and is causing considerable discussion in Provincial Governmental circles, as to whether or not certain restrictions should be placed against the wide powers granted to the Commission in the obtaining and the use of money.

The investment in the Ontario Power Company, the stock of which is entirely held by the Hydro-Electric Power Commission, amounted to \$25,489,590 in power development and to \$3,268,024 in transmission lines and sub-stations owned by the Ontario Transmission Company, which is a sub-

subsidiary of the Ontario Power Company. The total fixed assets, as given on the Ontario Power Company's balance sheet of October 31st, 1920, are, therefore, \$28,757,614. The Hydro-Electric Power Commission paid to the stock-holders of the old Ontario Power Company \$8,000,000 in Hydro-Electric Power Commission Bonds for \$11,000,000 par value of outstanding stock of the Ontario Power Company and the Ontario Transmission Company. The bonds of the Ontario Power Company outstanding on October 31st, 1920, together with interest coupons due and interest accrued, total \$14,040,118, while the investments made by the Hydro-Electric Power Commission since its assumption of the ownership of this property is represented by \$3,517,673 for the construction of the third pipe line and additional generating capacity. The total fixed liabilities, therefore, amount to \$25,557,791.

While about \$180,000 was written off for renewal reserves in the first year of operation, this was later credited to the payment for power from the Toronto Power Company as the result of a judgment received by that company through the courts. No renewal reserves were again charged off until 1920, when \$389,534 was set aside. The average renewal reserve over the three-year period of operation therefore amounts to about \$130,000 per annum, which, if applied at the rate for renewal reserves used by the Commission, would represent a physical valuation for the property of very much less than either the fixed assets or the fixed liabilities of the property.

In discussing this subject with Mr. F. G. Clarkson on November 16th, Mr. Clarkson stated that to date

the Ontario Power Company has set aside for renewals only that amount which it could afford. He stated that the reserves could not be computed against the total capitalization, as about \$10,000,000 does not represent physical value, and that he never has been able to determine where it came in. Mr. Clarkson further stated that the Commission's engineers feel that the amounts set aside are sufficient to provide for renewals.

Detailed Investments in Distribution System by the Municipalities on their Own Behalf as of December 31, 1920

Under the Hydro-Electric Power Commission plan the municipalities taking power from the Commission construct their own distribution systems under the supervision of the Commission. The municipalities issue their own debentures for such construction and these debentures are a direct liability of the municipality, being in no way guaranteed by the Province of Ontario.

The investments of the municipalities for each of the Hydro-Electric Power Systems are shown in Table No. 4, the total investment for the systems given being \$26,172,894, of which that of the municipalities receiving service from the Niagara System forms about 86% of the total.

Certain municipalities receiving power from government electric utilities have not, so far, made investments of their own in distribution systems. These municipalities receive service from the Central Ontario System, owned by the Province, and from the Essex and Thorold Systems, owned by the Hydro-Electric Power Commission. Both Mr. Gaby and Mr. Pierdon have stated that eventually

TABLE NO. 4
INVESTMENTS AND PHYSICAL ASSETS BY THE MUNICIPALITIES IN DISTRIBUTION SYSTEMS
ON THEIR OWN BEHALF
AS OF DECEMBER 31, 1920
INVESTMENT IN DOLLARS

System	Land and Buildings	Substation Equipment	Distribution System Overhead	Distribution System Underground	Line Transformers	Meters
Niagara	1,876,408	3,015,703	6,919,995	1,183,917	2,101,465	2,499,611
Severn	30,605	40,873	262,961		60,590	84,206
St. Lawrence	31,230		99,019		28,839	35,325
Waddell's	250		26,510		8,837	8,802
Muskoka	12,584	12,678	36,853		4,029	9,276
Eugenia	36,045	13,034	251,975		65,101	63,525
Rideau	26,440	10,834	115,262		36,605	41,017
Thunder Bay			222,376		19,657	50,310
Ottawa	713,993	128,283	388,321	84,704	142,143	141,670
Total	2,127,555	3,221,405	8,323,272	1,268,621	2,467,266	2,933,742

	Street Lighting Equip't Regular and Commercial	Misc. Construction Expense	Steam and Hydraulic Plants	Old Plants	Totals
Niagara	1,566,612	2,460,879	228,804	562,946	22,416,340
Severn	18,604	25,275		77,975	601,089
St. Lawrence	17,099	7,065		66,654	285,231
Waddell's	1,764	3,615		11,594	61,372
Muskoka	1,731	1,821		13,046	92,018
Eugenia	21,757	25,693		56,187	533,317
Rideau	3,929	19,162	70,722	24,441	348,412
Thunder Bay	29,180	11,179	380,274		712,976
Ottawa	90,778	32,247			1,122,139
Total	1,751,454	2,586,936	679,800	812,843	26,172,894

TABLE NO. 5

INVESTMENTS IN FACILITIES OF GOVERNMENTAL ELECTRIC UTILITIES FOR 1920 IN DOLLARS PER HORSEPOWER YEAR PURCHASED AND IN CENTS PER KW-HR. GENERATED OR PURCHASED

	Niagara	Severn	Eugenia	Wasdell's	Muskoka	St. Lawrence	Rideau	Ottawa	Thunder Bay	Total
Kw-hr. generated and purchased x 1000.....	155,344	4,868	3,246	327	1,306	1,477	1,727	6,951	5,685	180,930
Commission Investment per hp. purchased										
(a) Power Plants	(a) \$87	\$133	\$301	\$433	\$113	0	\$435	....	....	\$156
(b) Transmission	(a) 103	151	222	585	49	\$366	\$597	....	\$15	\$269
(c) Total	(a) \$190	\$284	\$523	\$1018	\$162	\$366	162	....	\$15	113
By Municipalities:										
(a) Distribution	146	123	164	187	71	193	203	161	125	144
Total	\$336	\$407	\$687	\$1205	\$233	\$559	\$800	\$161	\$140	\$413
Investments per kw-hr. generated and purchased, in cents:										
(a) By Commission	(a) 6.08	9.17	17.30	19.00	4.05	6.76	15.88	....	0.34	5.65
(b) By Municipalities ...	2.96	3.99	5.45	3.51	1.76	3.44	5.27	3.46	2.89	3.03
(c) Total	9.04	13.16	22.75	22.51	5.81	10.20	21.15	3.46	3.23	8.68
Kw-hr. purchased and generated for each hp. taken	4,870	3,080	3,020	5,360	4,020	5,420	3,760	4,670	4,330	4,750

(a) Adjusted to compensate for direct customers of Ontario Power Company.

the municipalities receiving power from these three systems will do so under the same plan as that under which the municipalities in Western Ontario are operating.

One other group of municipalities for which detailed costs are not obtainable has been omitted, and these municipalities receive power from what is known as the Trent System, which, in turn receives power from the Central Ontario System. The omission has been made for the reason that it was impossible to trace the cost of power from the source to that of delivery to the ultimate consumer.

Unit Investment Costs for the Several Systems, Together with Municipal Distribution Works, at the Termination of the Fiscal Year of 1920

Table No. 5 shows the unit investment in the facilities of government electric utilities for 1920 for each of the several systems operated by the Hydro-Electric Power Commission, with the exceptions that have been previously noted.

Unit costs are based upon the horsepower purchased for the municipal fiscal year ended December 31st, 1920, and also upon the basis of investment costs per kilowatt hour generated or purchased by the Hydro-Electric Power Commission.

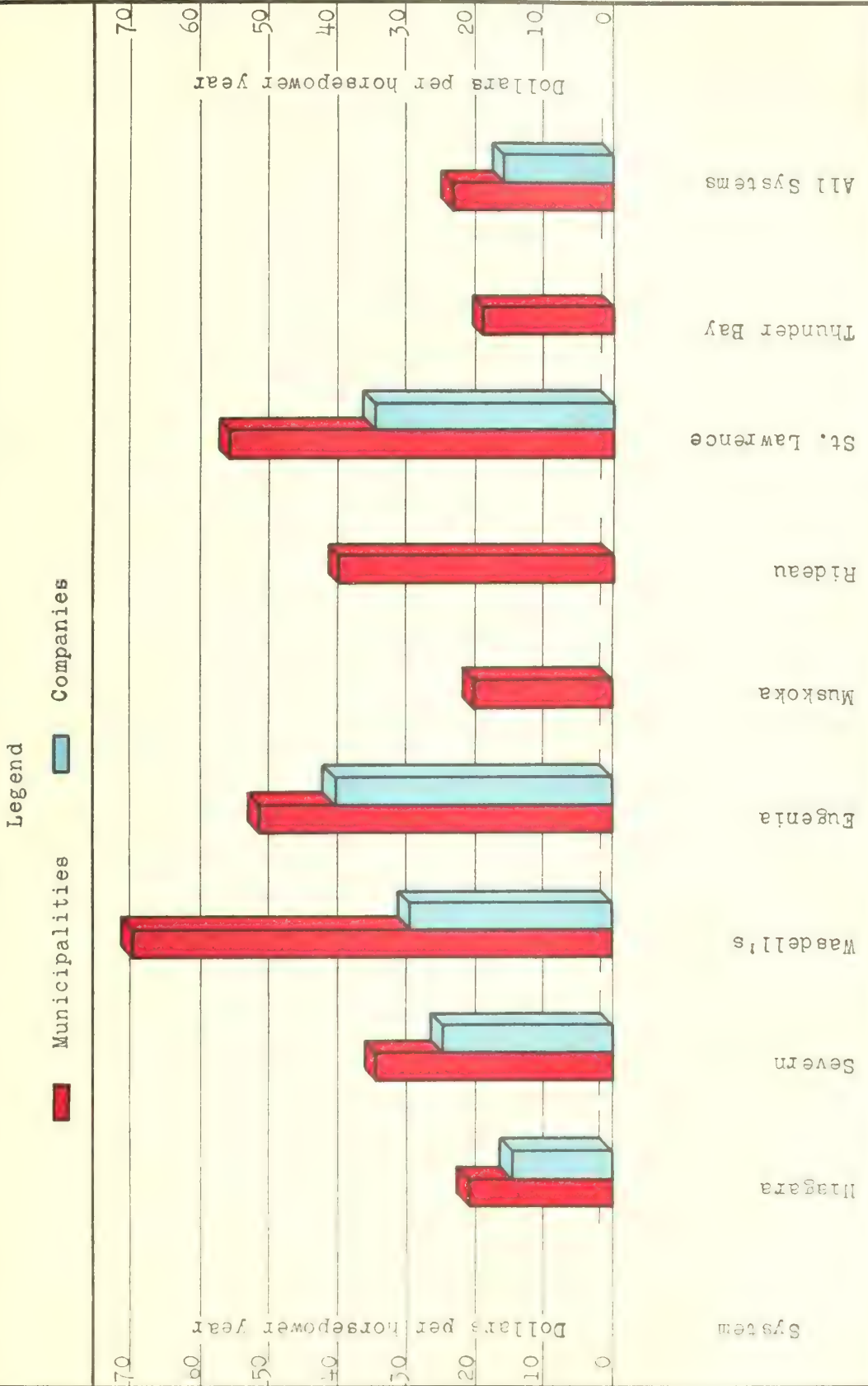
The Hydro-Electric Power Commission has installed kilowatt-hour meters only at its generating stations and principal sub-stations, and it is, therefore, impossible to determine the actual kilowatt-hour sales to the several municipalities. Furthermore, the Local Municipal Commissions do not meter their energy sales in such a manner as to make possible the determination of the actual energy sold to the ultimate consumer. The unit investment was therefore necessarily taken upon the basis of energy generated or purchased, rather than that of the energy sold to the ultimate consumer.

The Niagara System is complicated by the fact that the Hydro-Electric Power Commission exports a portion of the power generated by the Ontario Power Company to the United States, and also sells power direct to certain consumers other than to the Niagara System. These power sales make it necessary to adjust the investment for the Niagara System when the Ontario Power Company is considered a part thereof, so that the municipalities are not charged with the entire burden of the investment.

The investments of the Hydro-Electric Power Commission in power plants varies from \$87.00 per horsepower, purchased on the Niagara System, to as high as \$435.00 per horsepower, purchased for the Rideau System, while the cost of transmission system varies from as low as \$15.00 per horsepower, purchased for the Thunder Bay System, to as high as \$585.00, for the Wasdells System. The total investments in physical property made by the Commission on behalf of the municipalities ranges from \$15.00 per horsepower, purchased for the Thunder Bay System, to as high as \$1,018 for the Wasdells System, and the corresponding variations in unit investment costs per kw.-hr. are from 0.34 cents, for the Thunder Bay System, to 19.0 cents, for the Wasdells System.

The horsepower purchased is measured at the delivery point to each municipality, and there is considerable diversity between the sum of the loads at the municipal delivery points and the corresponding load upon the power station. Furthermore, it must be borne in mind that the term "horsepower purchased" is the average of the 12 highest 20-minute monthly peaks occurring during the year, so that this term does not of necessity have any relation whatsoever to the maximum demand for the year nor to the average horsepower taken, as computed from kw.-hr. meters were such available.

Figure 9
The wholesale cost for power to municipalities, for the several systems and to companies served directly by the H.E.P.C. in 1920.





The range of investments by the municipalities in distribution works is not so marked as that for the transmission lines and power plants of the Commission. This varies between a minimum of \$71.00 per horsepower, purchased for the Muskoka System, to \$203.00 per horsepower, purchased for the Rideau System, with a corresponding variation per kw.-hr. generated and purchased of between 1.76 cents, for the Muskoka System, and 5.45 cents, for the Eugenia System.

The last item of the Table No. 5, namely, the kw.-hr. generated and purchased per horsepower purchased, explains why the municipalities of a system, having the highest investment cost per horsepower taken, do not, of necessity, have the highest cost per kw.-hr. generated or purchased.

The complete investment required to serve the ultimate consumer has a wide variation. For the Thunder Bay System the investment cost per horsepower purchased is \$140.00, as compared to that for the Wasdells System of \$1,205.00. The corresponding variation in unit investment cost per kw.-hr. generated or purchased is from 3.23 cents per kw.-hr. for the Thunder Bay System to 22.75 cents per kw.-hr. for the Eugenia System.

It is of interest to note that the unit investment costs of the Thunder Bay System are the lowest of the entire group of systems in its relation to the construction of the Nipigon Development, which is discussed in Section G.

There are three systems having lower unit investment costs than that of the Niagara System. These are the Thunder Bay System, which for the year 1920 purchased practically the entire requirements from the Kaministiquia Power Company; the Ottawa System, which purchased its entire requirements from the Ottawa & Hull Power Company, located practically at the point of distribution, and the Muskoka System, which has a very cheap power development, and an exceedingly low transmission and distribution investment.

The Wholesale Cost for Power to the Municipalities of the Several Systems Served by the Hydro-Electric Power Commission as of October 31, 1920

Table No. 6 shows the wholesale cost for power to the municipalities of the several systems for 1920. This totals \$3,997,284. The wholesale cost for power to the municipalities of the Niagara System of \$3,180,159 represents approximately 80% of the total. The wholesale average cost of power sold to the municipalities and directly to companies by the Commission varies from \$14.05 per horsepower year for the Ottawa System to \$50.60 per horsepower year for the Eugenia System. The wholesale cost of power delivered to the municipalities of Port Arthur is \$19.00 per horsepower year, this being the second lowest wholesale price to the municipalities for any system.

The relation between the wholesale cost of power delivered by the Hydro-Electric Power Commission

to the municipalities, to that delivered by the Commission to companies contracting directly with it is shown in Figure 9. For the Niagara System the companies earned wholesale rate of 71% of that to the municipalities, while on the Wasdells System, the wholesale rate to the companies is only about 41% of that charged to the municipalities.

For the Niagara System the unit cost of power includes the cost of power purchased by the Commission and the cost of producing power in its own plants. The Hydro-Electric Power Commission purchased all of the power required for the Niagara System from the Canadian Niagara Power Company and from the Ontario Power Company, which it owns and controls as a separate entity from the Niagara System.

Power was purchased from private companies in 1920 for the Thunder Bay, the Ottawa and the St. Lawrence Systems, while generating plants owned by the Commission furnished the power to the Severn, Wasdells, Eugenia, Muskoka and Rideau Systems. For the Niagara System, the cost of power purchased was \$10.40 per horsepower year purchased, the unit cost for the transmission of the power to the municipalities being \$9.40 per horsepower year purchased. For the Thunder Bay System the cost of power was \$15.00 per horsepower year purchased, leaving \$4.00 per horsepower year as the cost for the transmission system. For many of the systems it is impossible to distinguish the cost of power from that of operation, maintenance and administration, as, where power plants are operated by the Commission, all of these are included under one item. Mr. Pierdon, Accountant for the Commission, has explained that the separation of the production costs from those of transmission would make it necessary to prepare a very involved table in order to comply with the law as set forth in the Power Commission Act.

The first annual statement of adjustments showing the proportional costs of the several municipalities receiving power from the Hydro-Electric Power Commission was made for the Niagara System in 1912, when the horsepower purchased amounted to 21,456. The total cost of power purchased by the municipalities of the Niagara System for that year averaged \$23.85 per horsepower year, of which "Cost for Power" constituted \$8.90, while that for the Transmission System was \$14.95. The "Cost of Power," as used by the Commission, designates the amount of money paid by the Commission for power purchased for the use of the system, and in that year all power was purchased from the Ontario Power Company, under the contract of 1908.

The engineers of the Hydro-Electric Power Commission, in designing the transmission lines, took into consideration the probable future requirements, and in the early days of operation the unit costs per horsepower year purchased were much higher than they now are, since many of these lines have become loaded, and, in face, Mr. Richardson of the Operating Department states that a number of the Commission's transmission lines are loaded at present to

MURRAY AND FLOOD REPORT

TABLE NO 6

THE WHOLESALE COST FOR POWER FROM THE HYDRO ELECTRIC POWER COMMISSION OF ONTARIO TO THE SEVERAL MUNICIPALITIES BY SYSTEMS AS OF OCTOBER 31ST, 1920.

ANNUAL COST IN DOLLARS

	Niagara	Niagara Rural	Severn	Wasdell's	Wasdell's Rural
Average hp. taken by municipalities.....	151,420	....	4,789	319	...
Average hp. taken by companies.....	37,419	....	904	590	...
Total average hp. taken.....	188,839	....	5,693	909	...
Cost of Power.....	1,966,304	61,247	12,853	....	...
Operation, maintenance and administration.....	585,098	1,019	59,939	14,732	...
Interest	644,859	23,794	62,755	13,526	583
Renewals and contingencies.....	348,019	811	39,306	6,191	...
Sinking Fund	195,569	8,894	16,439	5,296	199
Total	3,739,849	95,765	191,292	39,745	782
Credit revenue from sales to companies.....	559,690	4,997	22,448	17,614	...
Debit or credit from companies.....	3,180,159	90,768	168,844	22,231	782
Net cost to municipalities.....	3,180,159	90,768	165,947	22,231	782
Average cost per hp. year to municipalities.....	21.00	....	34.70	69.70	...
Average cost per hp. year to companies.....	14.95	....	24.90	29.70	...
Average cost per hp. year total.....	79.80	....	33.60	43.70	...

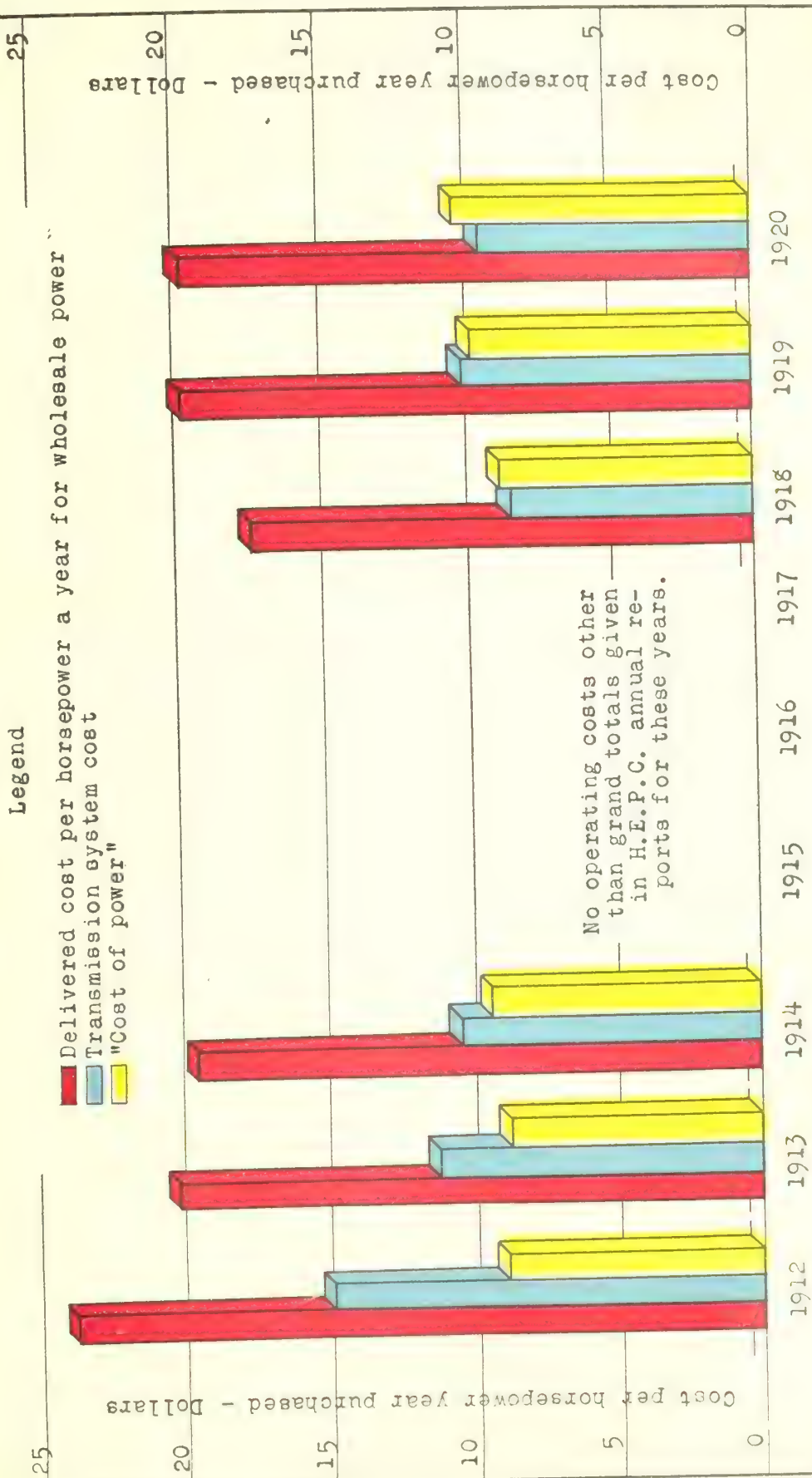
ANNUAL COST IN DOLLARS

	Eugenia	Eugenia Rural	Muskoka	Rideau
Average hp. taken by municipalities.....	3,191	....	1,350	1,637
Average hp. taken by companies.....	164	....	....	....
Total average hp. taken.....	3,355	....	1,350	1,637
Cost of Power.....	....	....	....	6,705
Operation, maintenance and administration.....	62,180	....	9,775	14,535
Interest	76,885	94	9,662	29,367
Renewals and contingencies.....	30,811	....	7,769	14,915
Sinking Fund .....	....	31	....	....
Total	169,876	125	27,206	65,522
Credit revenue from sales to companies.....	6,585	....	....	....
Debit or credit from companies.....	163,291	125	27,206	65,522
Net cost to municipalities.....	163,291	125	27,206	65,522
Average cost per hp. year to municipalities.....	51.20	....	20.20	40.40
Average cost per hp. year to companies.....	40.20	....	....	....
Average cost per hp. year total.....	50.60	....	20.20	40.00

ANNUAL COST IN DOLLARS

	St. Lawrence	Thunder Bay	Ottawa	Total
Average hp. taken by municipalities.....	1,457	5,468	6,799	176,430
Average hp. taken by companies.....	667	....	....	39,744
Total average hp. taken.....	2,124	5,468	6,799	216,174
Cost of Power.....	33,711	81,945	94,699	2,257,464
Operation, maintenance and administration.....	16,935	8,963	854	774,030
Interest	24,528	5,395	50	891,498
Renewals and contingencies.....	24,722	5,512	....	478,056
Sinking Fund	4,640	2,132	18	233,218
Total	104,536	103,947	95,621	4,634,266
Credit revenue from sales to companies.....	22,871	....	....	634,105
Debit or credit from companies.....	81,665	103,947	95,621	4,000,161
Net cost to municipalities.....	81,665	103,947	95,621	3,997,264
Average cost per hp. year to municipalities.....	56.00	....	14.05	22.60
Average cost per hp. year to companies.....	34.30	....	....	15.95
Average cost per hp. year total.....	49.20	19.00	14.05	21.40

Figure 10
Relation of "cost of power" and transmission cost to the total wholesale cost for power delivered by H. E. P. C. to municipalities of the Niagara System for 1912 to 1920.



such an extent that severe energy losses are being encountered.

The total wholesale cost for power per horsepower year delivered to the municipalities in 1920 amounted to \$19.80, compared to \$23.85 paid by them in 1912. This is a reduction in cost of about 17%, despite the increases in the cost of the elements involved to make the total. The reduction in cost would be even more marked had not the original sinking fund clause of the Hydro-Electric Power Act been so amended that the municipalities were relieved from paying sinking funds during the first five years of operation, and it was not until 1917 that the sinking fund payments were made by the municipalities originally taking power under the Hydro-Electric Power Act. The figure of \$23.85 per horsepower year for 1912 included no amount for the sinking fund as required after 1917.

Figure 10 shows the total average wholesale cost for power to the municipalities of the Niagara System, together with the two principal elements making up this cost, namely, the cost of power and the cost of transmission. The figure covers the period between 1912 and 1920, but because of the fact that the operating figures are given only in total for the years of 1915, 1916 and 1917, those years have been omitted.

The cost for power per horsepower year purchased in 1912 was \$8.90, and this decreased by 1918 to \$8.85, or by about 1%, while the cost for transmission per horsepower year purchased decreased from \$14.95 to \$8.35, a reduction of about 44%.

The mounting cost for commodities and labor are reflected in the 1920 cost, in that the cost for power increased to \$10.40 per horsepower year, an increase of 16.8% over that for the cost of power in 1912, while that for transmission operation was \$9.40 per horsepower year, a decrease of 37% over 1912, but an increase of about 11.4% over that of 1918. The loading of the transmission system has thus compensated, to a degree, for the increase in production costs for power, and the resulting wholesale cost to the municipalities therefore is less today than it was when the system was started.

The Production Cost for Power for the Ontario Power Company

The Hydro-Electric Power Commission in 1908 made a contract through which it received power from the Ontario Power Company, then privately owned and operated, for \$9.40 per horsepower-year up to 25,000 horsepower, and for \$9.00 per horsepower year for the balance up to a total of 100,000 horsepower. The basis of the charge was the highest twenty-minute peak occurring each month.

By 1915, the demands of the Niagara System for power exceeded the 100,000 horsepower permitted by the contract, and negotiations were entered into between the Commission and the owners of the Ontario Power Company which resulted in its purchase by the Commission on August 1, 1917.

In purchasing the Ontario Power Company, the

Commission assumed the liabilities and the contracts of that company, among which was a contract with the Niagara, Lockport and Ontario Power Company for the delivery of 60,000 horsepower at a rate of \$14.78 per kilowatt-year for a period extending to 1950. Power contracts on the Canadian side also were assumed, for which the expiration dates varied from a few years after the time of purchase to as late as 1937.

With respect to the acquisition of the Ontario Power Company, Sir Adam Beck stated before the Committee on Water Power of the House of Representatives on April 15, 1918:

"Negotiations were entered into, and the Hydro-Electric Power Commission acquired the plant and took possession after about a year's negotiation. The remaining 60,000 horsepower of capacity is under contract to the Niagara, Lockport & Ontario Power Company. We assumed the whole of the bonded indebtedness of the company, amounting to about \$14,000,000. We acquired the common stock of the company and paid them \$8,000,000 in forty-year Hydro-Electric Power Commission 4% Bonds, guaranteed by the Province of Ontario. The purchase included a transformer station and a short system of lines in the immediate vicinity of the plant itself. During the first year of operation we reduced the cost of operation by over \$40,000. The revenue from our two firm contracts, one with the municipalities, and one with the Niagara, Lockport & Ontario Power Company, expiring in 1950, will be sufficient to maintain the plant at the highest point of efficiency, provide for renewal and depreciation charges and operation, and at the same time accumulate sufficient revenue to retire the whole of the debt in 25 years. That is, instead of the Ontario Power Company owning this plant in 25 years, we will, out of the reserves that we are setting aside, pay off the whole of our indebtedness, and own the plant free of debt in 25 years from last August."

The Chairman: "Without increasing the cost to the consumer?"

Sir Adam Beck: "Yes, we are bound by contract. One contract is \$9.00 for 100,000 horsepower, and the contract with the Niagara, Lockport & Ontario Power Company is for 60,000 horsepower at \$12.50. The revenue from those two contracts will provide enough money to pay off and retire all debts, including the 40-year bonds, in 25 years, after which we will own and control the plant and operate it to the best advantage of all concerned. More than that, when the time comes that more water or power is essential, we can take the ten or twelve thousand cubic feet per second of water now being used comparatively inefficiently in the Ontario Power

TABLE No. 7

COMPARISON OF PRODUCTION COSTS FOR THE ONTARIO POWER COMPANY UNDER PRIVATE AND GOVERNMENTAL MANAGEMENT

ANNUAL COST IN DOLLARS

	Owned by Private Corporation		
	1915	1916	1st 5 months 1917
Purchased Power	\$ 283,437	\$ 531,008	\$ 241,165
Operating, Maintenance and Administration	229,253	233,108	94,774
Water Rental, Taxes and Insurance	190,546	214,840	94,475
Bond Interest and Discount and American Exchange	974,289	932,718	384,721
Sinking Fund Payments	82,550	135,348	28,734
Surplus for Obsolescence, Dividends, etc.	373,546	548,698	264,470
Total Revenue	\$2,133,621	\$2,595,720	\$1,108,339
Kw-hr Generated	757,713,600	942,221,900	
Kw-hr Purchased	126,608,400	252,175,200	
Kw-hr Total	884,332,000	1,194,397,100	
Revenue per kw-hr generated, mills	2.57	2.18	
Revenue per kw-hr purchased, mills	2.24	2.27	
Revenue per kw-hr total, mills	2.42	2.19	

ANNUAL COST IN DOLLARS

	Owned by Hydro-Electric Power Commission of Ontario		
	Fifteen months 1918	1919	1920
	Aug. 1, 1917, to Oct. 31, 1918		
Purchased Power	\$ 789,835 (a)	\$ 340,536	\$ 125,073
Operating, Maintenance and Administration	290,178	351,591	401,767
Water Rental, Taxes and Insurance	257,980	197,814	212,074
Bond Interest and Discount and American Exchange	1,001,257	912,918	1,056,683
Sinking Fund Payments	84,620	65,708	69,106
Surplus for Obsolescence, Dividends, etc.	399,651	405,008	858,648
Total Revenue	\$2,823,521	\$2,273,575	\$2,723,325
Kw-hr Generated		915,365,500	1,034,621,452
Kw-hr Purchased		83,591,900	58,434,000
Kw-hr Total		998,957,400	1,092,055,452
Revenue per kw-hr generated, mills		2.01	2.51
Revenue per kw-hr purchased, mills		4.08	2.14
Revenue per kw-hr total, mills		2.28	2.49

(a) \$189,640 added for power from Electrical Development Company required to be paid by Court decision and this same amount added to the 1918 total.

Company plant, and use it in connection with our Queenston-Chippawa scheme, thus securing the advantage of the full head available between the two lakes."

In Table No. 7 is shown the total production cost for the Ontario Power Company for the entire period of 1915, 1916 and the first five months of 1917, during which time this company was under private management. There is shown further the production costs from August 1, 1918, to the end of the Commission's fiscal year of 1920. Analyzing Table No. 7 makes it very difficult to see where the cost of operation was reduced by \$40,000, during the first year, for the reason that during the five months of 1917 for which records were available the cost for operation, maintenance and administration was at the rate of \$237,000 per annum, as against \$232,000 per annum for the first fifteen months of operation by the Hydro-Electric Power Commission. This class of cost should vary but little from month to month, and the result indicates that the saving was about \$5,000, rather than the \$40,000 stated. It is possible, however, that the Commission included

the lower costs for water rentals and taxes, and while these were at an annual rate of \$236,000 under private management for 1917, they were reduced to an annual rate of \$206,000 for the first fifteen months under governmental operation. The saving effected for this class of costs is not a true money saving, for the loss of taxes and rentals to the municipalities and the Province must be made up by other forms of taxation, and the cost is merely transferred from the power-user to the tax-payer.

In 1917, when the Commission assumed the ownership of the Ontario Power Company, permission was obtained from the Queen Victoria-Niagara Falls Park Commission to enlarge the capacity of the Ontario Power Company by the addition of a third pipe line and the installation of two generating units having a total capacity of approximately 40,000 horsepower. The demand for power for war purposes at that time was very pressing, and the Commission asked for a permit having a life of approximately five years.

The report of Mr. G. T. Clarkson, in respect to the operations of the Ontario Power Company

for the year ending October 31, 1919, states with reference to the expenditures on construction of third pipe line to the works of the Company, including additional generating equipment:

"To 31st October, 1918, the sum of \$1,349,070.63 had been expended upon the above work, and during the fiscal year to 31st October, 1919, an additional amount of \$2,161,370.39 was expended in connection therewith, moneys for such purposes having been advanced by the Commission to the company. It was expected that the proceeds of sale of additional power to be obtained with use of the third pipe line with indemnities looked to be received from the Dominion Government would be sufficient to return the cost of the same—originally estimated at between \$1,500,000 and \$2,000,000—to the company and accordingly the Ontario Power Company executed an agreement with the Commissioners of the Queen Victoria Niagara Falls Parks, under which it agreed to remove the pipe line by the spring of 1923. The Commission states that the Commissioners of the Queen Victoria Niagara Falls Parks have now agreed to allow the pipe line to remain for as long as the Power Company shall require it. I recommend that steps be taken to protect the company in its investment and that it be authorized to repay the costs of the third pipe line and equipment on a sinking fund basis over an extended period of years; otherwise the loss which would be sustained with its removal at an early date would have to be written off as part of the cost of power generated; this would reflect severely in the accounts of the company and increase the costs of power to the municipalities on the Niagara System.

The accounts which are now presented to you are based on the assumption that repayment of the cost of the third pipe line and equipment will be permitted to be made by the Ontario Power Company over an extended period, and the sum of \$150,000 repaid by the Power Company to the Commission during the fiscal year ending 31st October, 1919, has been accepted as fully satisfying requirements to that date."

The Sinking Fund recommended by Mr. Clarkson for the fiscal years of 1919 and 1920 has been paid from capital surplus rather than from the revenue obtained in these years.

During the fiscal year ended October 31, 1918, the Ontario Power Company set aside \$180,000 for its renewal reserve. In 1919, as a result of court action, the Ontario Power Company was required to pay to the Toronto Power Company \$186,642 as the additional cost of power purchased to October 31st, 1918, and in order to meet these payments, Mr. Clarkson made recommendations as follows:

"The sum of \$180,000 was provided as an interim allowance for renewal of plant, equip-

ment and transmission lines to 31st October, 1918, but in view of the conditions mentioned in the report made by me to the Honourable E. C. Drury, Premier of Ontario, and dated 19th, March, 1920, this item has now been reversed with the intention that the Company shall be relieved from the necessity of providing reserves for renewals of plant and equipment for the period to October 31, 1919."

Thus, for the first 27 months of operations, the Ontario Power Company made no provision for renewal reserve, but for the fiscal year of 1920 it set aside, out of revenue, \$385,498 for this purpose.

In discussing the subject of renewal reserves with Mr. Clarkson on November 16, 1921, he stated that renewal reserves had been set aside by the Ontario Power Company only to the extent that it could afford, and that the renewal reserves set aside for the fiscal year of 1920 was considered adequate by the Commission's engineers, for the reason that about \$10,000,000 of the total capitalization of the company was not represented by physical property.

The unit operating costs for the Ontario Power Company were 2.42 mills per kilowatt-hour generated and purchased for 1915, and this was reduced to 2.19 mills for 1916. Under government ownership for 1919 and 1920 the same unit costs were 2.28 mills and 2.49 mills, respectively. Output figures were not available for 1917 and 1918. The unit production cost per kilowatt-hour generated for the Ontario Power Company was 2.57 mills for 1915, 2.18 mills for 1916, 2.10 mills for 1919 and 2.54 mills for 1920.

Inter-relation of the Ontario Power Company and the Niagara System

The Ontario Power Company is operated as a distinct entity, separate from the Niagara System, to which it furnishes the larger part of its output. The contractual relation in respect to the purchase of power by the Hydro-Electric Power Commission from the Ontario Power Company, which was in existence prior to the purchase of the power company by the Commission, has been continued and it is understood that the Niagara System pays for power taken from the Ontario Power Company up to 100,000 horsepower under the terms and conditions of the original contract made in 1908. For power in excess of 100,000 horsepower taken by the Niagara System from the Ontario Power Company, the price paid is \$18.00 per horsepower. The Niagara System, in addition to purchasing power from the Ontario Power Company, purchases directly from the Canadian Niagara Power Company at a rate of \$12.00 per horsepower year delivered at 12,000 volts at the Niagara Sub-Station for 50,000 horsepower and \$18.00 per horsepower year for all above that amount. On the other hand, the Ontario Power Company purchases power directly from the Electrical Development Company, which it sells to the Niagara System or to other customers with whom it has contracts.

The principal customer of the Ontario Power

Company outside of the Niagara System of the Hydro-Electric Power Commission is the Niagara-Lockport & Ontario Power Company which has a long term contract for 60,000 horsepower.

The inter-relation of these various power companies is complicated, and in order to present the situation as a whole, Table No. 8 has been prepared, showing the annual expense of the Ontario Power Company and of the purchase of power from the Electrical Development Company and the Canadian-Niagara Power Company respectively. Likewise, in Table No. 9 the energy produced by the Ontario Power Company, the energy purchased from the Electrical Development Company and the Canadian-Niagara Power Company is shown, together with the unit costs for such energy.

TABLE NO. 8

THE ANNUAL EXPENSE FOR OPERATING THE ONTARIO POWER COMPANY AND OF PURCHASING ADDITIONAL POWER FOR THE NIAGARA SYSTEM IN 1919 AND 1920.

	1919	1920
1. Production Cost—Ontario Power Company:		
(a) Power Purchased from Electrical Development Company	\$340,536	\$125,073
(b) Direct charges against Ontario Power Company.....	1,787,566	2,494,960
(c) Total Production cost Ontario Power Company	\$2,128,102	\$2,620,033
2. Power Purchased by H.E.P.C.:		
(a) Canadian Niagara Company..	623,644	853,486
3. Total Production cost for Ontario Power Company plus H.E.P.C. Canadian Niagara System	2,751,746	3,473,519
4. Surplus of Ontario Power Company carried to balance sheet.....	145,473	103,320
5. Total Revenue to H.E.P.C. from power production of Ontario Power Company and Purchased Power	\$2,897,219	\$3,576,839
The total combined expenses of the Ontario		

Power Company, plus the energy purchased for its account or for the account of the Niagara System for 1920, was \$3,578,839 of which the power purchased from the Canadian-Niagara Power Company amounted to approximately 24% and that purchased from the Electrical Development Company approximately 3½%, leaving 72½% of the total cost for power generated and purchased as the generation cost for the Ontario Power Company.

The total kilowatt hours generated and purchased in 1920 amounted to 1,425,443,194. Of this, the Canadian-Niagara Power Company contributed 23%, and the Electrical Development Company 4%, leaving the energy generated by the Ontario Power Company 72½% of the total. The annual peak upon the Ontario Power Company plant for the year 1920 was 152,000 kilowatts, or about 204,000 horsepower.

In discussing the inter-relation of these several power companies, Mr. Stanley Richardson of the Operating Department of the Hydro-Electric Power Commission stated that the contracts in force with the Canadian-Niagara Power Company and the Electrical Development Company were virtually contracts for purchase of the capacity reserved by those companies, for the use of either the Niagara System or the Ontario Power Company, and, accordingly, for the unit costs per horsepower year, the amount of capacity reserved by these two companies has been used.

The resulting unit costs vary between \$9.32 per horsepower year, for the power purchased from the Electrical Development Company, and \$14.30 per horsepower year, for that purchased from the Canadian-Niagara Power Company, with the generation costs of the Ontario Power Company standing at \$12.70 per horsepower-year of peak demand. The peak demand of the Ontario Power Company for 1920 was, as a matter of fact, about

TABLE NO. 9.

POWER GENERATED AND PURCHASED AND UNIT COSTS FOR GENERATION BY THE ONTARIO POWER COMPANY AND FOR POWER PURCHASED FROM THE CANADIAN-NIAGARA POWER COMPANY FOR 1919 AND 1920

	1919		1920	
	hp.	Kw-hr.	hp.	Kw-hr.
Ontario Power Company—Generated.....	200,000	915,365,500	204,000	1,034,621,452
Electrical Development Company—Purchased.....	15,640	83,591,900	13,405	58,434,000
Total		998,957,440		1,093,055,452
H.E.P.C.—Purchased from Canadian Niagara Company..	50,000	310,577,030	59,750	332,387,742
Total Generated and Purchased.....		1,309,534,430		1,425,443,194
	Dollars per hp. year	Mills per kw-hr.	Dollars per hp. year	Mills per kw-hr.
Ontario Power Company—Generation.....	9.63 (a)	2.10 (c)	12.70 (a)	2.54 (c)
Electrical Development Company—Purchased.....	21.80 (b)	4.07	9.32 (b)	2.15
Canadian Niagara Power Company—Purchased	12.46 (b)	2.01	14.30	2.57
Total		2.21 (c)		2.51 (c)

(a) Based on annual peak upon the company's plant.

(b) Based on capacity reserved for use of Hydro.

(c) Based on revenue of Ontario Power Company.

equal to the capacity, which is stated as 201,600 horsepower.

The energy costs for these plants for the fiscal year of 1920 vary between 2.15 mills per kilowatt-hour for the energy purchased from the Electric Development Company, and 2.57 mills per kilowatt-hour for that purchased from the Canadian-Niagara Power Company, while the cost for generation at the Ontario Power Company was 2.54 mills per kilowatt-hour.

The energy generated by the Ontario Power Company, plus the purchases of that company and the Niagara System, are sold to three groups of customers, namely, the Hydro-Electric Power Commission for the Niagara System, the Niagara-Lockport & Ontario Power Company and to other customers having direct contractual relations with the power company.

Of the total energy generated and purchased the Hydro-Electric Power Commission uses on its Niagara System 57%, while that delivered to the Niagara-Lockport & Ontario Power Company for the fiscal year of 1920 was approximately 25%. The balance, or 18%, was taken by the power consumers contracting directly with the Ontario Power Company. For 1920 the energy rate per kilowatt-hour to these three groups of customers was lowest to the Niagara-Lockport & Ontario Power Company, being approximately 2.0 mills per kilowatt-hour as compared to 2.45 mills for energy sold to the Niagara System and 2.62 mills for energy sold to the other customers of the Ontario Power Company.

It has been found impossible to allocate the revenue from these three groups of customers per horsepower-year of demand to the busses of the generating stations, due to the location of the meters for making such measurement and, therefore, the unit prices for power sold per horsepower-year, as given in Table No. 11 bear no relation to each other.

Table No. 10, showing revenue of the Ontario Power Company and that from the Niagara System of the Hydro-Electric Power Commission, under the item "Cost of Power" shows a total cost for the fiscal year 1920 of \$3,576,839. This, it will be noted, balances the total expense given in Table No. 8, as in this latter table the surplus of the Ontario Power Company is carried forward to the balance sheet of the succeeding year.

By the Power Commission Act, profits accruing from the operation of the Ontario Power Company revert to the benefit of the municipalities taking

TABLE NO. 10
THE REVENUES OF THE ONTARIO POWER COMPANY WITH THOSE RECEIVED BY THE HYDRO-ELECTRIC POWER COMMISSION FOR "COST OF POWER" TO THE NIAGARA SYSTEM IN 1919 AND 1920

	1919	1920
1. Revenue of the Ontario Power Company:		
(a) From H.E.P.C.	\$893,814	\$1,112,818
(b) From Niagara, Lockport & Ontario Power Company...	618,116	702,669
(c) From All Other Customers	686,491	685,135
(d) Total Power Sales.....	\$2,198,421	\$2,500,622
(e) From Miscellaneous and Indirect Sources	75,154	222,731
(f) Total Ontario Power Co. Revenue	\$2,273,575	\$2,723,353
2. Cost of Power to the Niagara System:		
(a) As stated in Vol. I of H.E.P.C. reports	\$1,517,458	\$1,966,304
(b) Less H.E.P.C. payments to Ontario Power Co.....	893,814	1,112,818
(c) From Purchased Power other than Ontario Power Company	\$623,644	\$853,486
3. Total Revenue of Ontario Power Company plus cost of other power purchased by H.E.P.C. for the Niagara System	\$2,897,210	\$3,576,839

TABLE NO. 11
POWER SALES AND UNIT PRICES FOR POWER SOLD BY THE ONTARIO POWER COMPANY AND THE HYDRO-ELECTRIC POWER COMMISSION FOR THE NIAGARA SYSTEM IN 1919 AND 1920

	1919		1920	
Power Sold to:	Horsepower	Kilowatt Hours (d)	Horsepower	Kilowatt Hours (d)
H. E. P. C. for Niagara System.....	155,836 (a)	672,188,330	188,978 (a)	803,775,805
Niagara, Lockport and Ontario Power Co..	49,038 (b)	311,266,900	51,207 (b)	350,255,600
Other customers of the Ontario Power Co..	53,330 (c)	324,033,490	48,367 (c)	261,233,030
Total		1,307,493,720		1,415,264,435
Unit Price for Power:	Dollars per hp. year	Mills per kw. hr.	Dollars per hp. year	Mills per kw. hr.
To Niagara System	9.72	2.26	10.40	2.45
To N. L. & O. P. Co.....	12.60	1.99	13.70	2.00
To other customers of Ontario Power Co..	12.80	2.12	14.20	2.62
Total Power sales.....		2.16		2.36

- (a) Average of monthly peaks measured at point of delivery.
 (b) Average of monthly peaks measured at Ontario Power Company.
 (c) Average horsepower based on demand and kw-hr. meters
 (d) Generated and Purchased energy.

power from the Niagara System, through the reduction of rates for wholesale power, and, on the other hand, should any deficits occur, these municipalities are liable for such losses.

The peak load carried for 1920 by the Ontario Power Company was about 204,000 horsepower, making an annual load factor for the operation of that company in 1920 of 74.9%. For the fiscal year of 1919 the load factor was not as high, being about 69.7%.

Considering the amount of capacity reserved by the Canadian-Niagara Power Company and the Electrical Development Company in 1920 as actual capacity of the Commission, the total capacity available to the Commission for 1919 was 277,150 horsepower.

In discussing the diversity existing between the sum of demands of the various municipalities and that impressed upon the busses of the generating stations furnishing power to the Niagara System, Mr. Richardson stated that during the period of power shortage this diversity was over 20%, as nearly as they could ascertain. The fact that the Commission had been forced to cut off power from some of the customers during the period of power shortage made the computation of true diversity impossible. Mr. Richardson stated, however, that when ample capacity was available to the system,

the average of the monthly amounts of power paid for by the municipalities would be greater by about 10% than the peak-load resulting at the source of power.

The Hydro-Electric Power Commission is paid for its power upon the basis of the maximum 20-minute peak for each month. Its contracts with the municipalities provide for a charge of at least 75% of the power reserved for the use of the municipalities, whether or not power to this extent is taken. A certain portion of the diversity arises due to the municipalities being billed for a minimum of 75% of the power reserved, and further diversity has resulted from the cutting off of power from the customers during the period of power shortage.

The price of \$10.40 per horsepower year for power sold to the Niagara System is the delivered horsepower purchased by the municipalities, and if, during 1920, when there was a power shortage, the diversity was 20%, a resulting cost for power for the Niagara System at the source would have been \$12.70 per horsepower of maximum demand. These figures should not be confused with those given in Table No. 6, which are the total wholesale cost for power to the municipalities, including the cost of operating the transmission system.

TABLE NO. 12
THE RETAIL COST FOR POWER TO THE ULTIMATE CONSUMERS SERVED BY THE MUNICIPAL COMMISSIONS AS OF DECEMBER 31, 1920

	ANNUAL COSTS IN DOLLARS				
	Niagara	Severn	Wasdell's	Eugenia	Muskoka
Horsepower taken from Commission for fiscal year ending Oct. 31, 1920.....	151,420	4,789	319	3,191	1,350
Horsepower taken from the Commission for fiscal year ending Dec. 31, 1920.....	155,344	4,868	327	3,246	1,306
Power purchased from the Commission.....	3,344,747	170,576	23,028	162,063	26,609
Operation, Maintenance and Administration.....	2,031,557	32,880	4,317	32,457	8,158
Municipal debenture charges and interest.....	1,184,802	24,679	5,142	34,525	6,585
Renewal reserves.....	761,504	23,186	1,625	18,081	3,054
Total operating expenses.....	7,322,610	251,321	34,112	247,126	44,406
Total revenue from ultimate consumers.....	7,982,614	243,640	33,200	210,867	43,345
Surplus or deficit.....	660,004	7,681	912	36,259	1,061
Resulting cost to the ultimate consumer.....	7,982,614	251,321	34,112	247,126	44,406
Resulting cost to the ultimate consumer per hp. year purchased.....	51.25	51.50	104.40	76.20	34.00
Total expenses per hp. year.....	47.10	51.50	104.40	76.20	34.00

	ANNUAL COSTS IN DOLLARS				
	Rideau	St. Lawrence	Thunder Bay	Ottawa	Total
Horsepower taken from Commission for fiscal year ending Oct. 31, 1920.....	1,637	1,457	5,488		
Horsepower taken from the Commission for fiscal year ending Dec. 31, 1920.....	1,727	1,477	5,685	6,951	180,931
Power purchased from the Commission.....	66,965	79,554	108,230	96,791	4,078,563
Operation, Maintenance and Administration.....	36,627	34,299	45,511	111,381	2,337,187
Municipal debenture charges and interest.....	26,380	22,145	44,358	41,927	1,390,543
Renewal reserves.....	9,999	7,121	11,492	42,800	878,862
Total operating expenses.....	139,971	143,119	209,591	292,899	8,685,155
Total revenue from ultimate consumers.....	130,260	133,258	273,635	305,310	9,356,129
Surplus or deficit.....	9,711	9,861	64,044	12,411	670,974
Resulting cost to the ultimate consumer.....	139,971	143,119	273,635	305,310	9,356,129
Resulting cost to the ultimate consumer per hp. year purchased.....	81.00	97.00	48.15	43.90	51.80
Total expenses per hp. year.....	81.00	97.00	36.85	42.20	48.00

The Retail Cost for Power to the Ultimate Consumer as of December 31, 1920

The Hydro-Electric Power Commission whole-sales power to the several municipalities, which in turn retail the power to the ultimate consumers. The total retail cost for power to the ultimate consumers for the systems enumerated in Table No. 12, excluding the companies to which the Commission serves power directly, was \$9,356,129 for the fiscal year ended December 31, 1920, and the unit cost to the ultimate consumer varied from a minimum of \$34.00 per horsepower-year for the Muskoka System to a maximum of \$104.40 per horsepower-year for the Wasdells System. There were two systems, namely, the Thunder Bay and the Ottawa System, which retailed power to the ultimate consumer at an average price of less than that of the Niagara System, which was \$51.25 per horsepower-year.

As has been explained previously, the Hydro-Electric Power Commission is required by law to keep its accounts for a fiscal year ending October 31st, while the municipalities keep their books for a fiscal year ending December 31st. In the annual report of the Hydro-Electric Power Commission, the horsepower purchased by the municipalities during the fiscal year is not stated, so that ordinarily it would be impossible to ascertain accurately the unit retail cost. In order to accurately ascertain the unit cost given in Table No. 12, it was necessary to ask Mr. Pierdon, Accountant for the Commission, to ascertain the horsepower purchased by the municipalities for each system for the year ended December 31, 1920, and the information contained in the table is based upon the amounts of power purchased, as furnished by Mr. Pierdon.

It is hardly probable that the load factor for the entire district served by the government systems enumerated in the Province of Ontario is higher than that for the Superpower Zone in the United States, which, for the year 1919, was slightly less than 39%. Assuming, however, that the load factors were the same, the average retail cost to the ultimate consumer served by the government electric utilities of \$51.80 per horsepower year results in an average retail cost of 2.04 cents per kilowatt-hour-delivered.

The Accounting Practices of the Hydro-Electric Power Commission of Ontario

The accounts published by the Hydro-Electric Power Commission are kept to conform with the law as set forth in the Power Commission Act and it is impossible to show from them the efficiency in the operation of any of the several elements going to make up the cost. These accounts are so different from those published for privately-owned American companies that considerable study had to be given them in order to ascertain the cost elements considered in each individual item.

Through the Chief Engineer of the Commission,

Mr. F. A. Gaby, and the Accountant, Mr. W. G. Pierdon, we have been able to examine such of the books of the Commission as we desired and no request to inspect detailed statements, work orders, etc., made by us has been refused by these gentlemen, who have taken particular pains to explain to us the interpretations used by the Commission in respect to their methods of accounting.

The examination of the accounting practices of the Commission and of such detailed accounts was general, and was in no sense an audit.

In preparing Tables No. 2 to 12, previously presented in this Section, we submitted them to Mr. Pierdon, who had them checked by his staff, so they may be considered as entirely reliable.

As has been brought out in Section C, detailed accounts are kept in accordance with a standard system for accounting adopted by the Commission, which does not differ materially from that of the National Electric Light Association, and, by the nature of the law under which the Commission operates, it is necessary for them to be minutely sub-divided in order to determine the proportional investment and operating cost to each of the municipalities. The accounts can be so summarized, if desired, as to show the efficiency of the management for any of the elements going to make up the total of the property.

Certain of the accounting principles of the Commission are discussed in the following:

1. *Construction Accounts:*

All construction undertaken by the Commission is accounted for through work orders, by means of which the money spent is eventually assigned to the proper fixed capital account. All active work orders for the year 1920 were examined for the date issued, the class of work being done and the date completed, principally to determine whether interest, properly chargeable against "revenue," was being charged against "capital." The Commission's practice with regard to such construction accounts is to charge all expense on such property against "revenue" after the date service has first been received from the property in question. The work orders examined indicated that such was the case, which was further borne out by the statement made by Mr. G. T. Clarkson, the auditor employed by the Province in respect to Hydro-Electric Commission matters, who, when interviewed November 16th, 1921, stated that all expense against property is charged to revenue after the date any specific property goes into operation.

2. *Interest Charges:*

The Hydro-Electric Power Commission receives its funds principally in the form of cash advances from the Province of Ontario, upon which interest is paid to the Province at the interest rate which the Province must pay upon its own borrowings. The Commission has but one interest account against which two charges are made, first, the total amount of the Commission's check made payable to the Provincial Treasurer for the sum paid him on account of interest on borrowings; second, the interest

on the Commission's total reserves, which reserves include renewals, contingencies and sinking fund, applicable both to the properties of the several systems operated and to the departmental operations, such as office buildings, machine shops, stores and sales and laboratory. This latter interest item is required by the Power Commission Act, which provides for the improvement of reserves at the rate of 4% per annum. All reserves are set aside at such rate to accumulate the required principal within stipulated periods; for instance, thirty years for sinking funds, and from twelve to twenty-five years for renewals, depending upon the character of the property against which the application is being made. While, under present conditions, higher rates of interest than the 4% required can be earned, it is obvious that if it were applied to the improvement of the reserves these would increase more rapidly than required, and at the same time the municipalities would be obliged to assume in their power cost for each year the expense of the higher rate of interest, thus increasing the cost of power to them.

The total of the check paid to the Province for interest on all money borrowed and the interest on reserves forms the debit side of the interest account of the Commission. The expense side of this account is cleared out as follows:

- (1) By the application of a sum against all construction in progress based upon the rate of interest being paid by the Commission to the government during the period in which the construction takes place.
- (2) The balance of the account is closed out by applying the same to the various systems' operation, but, before so doing, this balance is reduced to some extent by reason of a charge of 7% per annum as commercial cost on all overdue accounts, which is credited into the portion of the interest account.

When the Commission started its operations, the cost of money to it was about 4%. This continued until November 1st, 1914, when the cost increased to 5%, where it remained until November 1st, 1917. Since that year, there has been a change for each fiscal year, the rates paid to the Province being as follows:

Fiscal year 1918.....	6.188%
" " 1919.....	5.341
" " 1920.....	6.2
" " 1921.....	6.5

At the end of the fiscal year 1920, the Commission's borrowings amounted to about \$66,549,000, of which only about \$20,000,000 was in operating accounts, the balance being in construction in progress accounts, principally in the Nipigon, Chippawa and Hydro-Electric railway developments. With the method adopted by the Commission of charging the construction account with the current rate for

interest, and taking into consideration the relative amounts of moneys invested in operating properties and construction in progress, the resultant average rate of 4.55% for interest on the capital in properties operating at the end of 1920 is relatively low when compared to that for the current rate of 6.2% paid to the Province for the year 1920.

When the large amount of construction now in progress is placed in operation, the average rate for interest on operating properties will be materially increased and probably will be not less than 5.75%.

3. Sinking Funds:

The Power Commission Act requires the Hydro-Electric Power Commission to set aside annually a sinking fund sufficient to repay the capital in 30 years, granting relief from this payment for the first five years of operation. In other words, the capital must be repaid within 35 years from the date operation was commenced. The Act further requires that all sinking funds shall be invested in the debentures of the Province of Ontario, and that the improvement on the same shall be taken at not less than 4% per annum.

In the operations of the several systems, the sinking fund requirement has been regularly taken care of, but in the case of the Ontario Power Company, this company has been considered a separate entity from the other systems operated by the Commission, and the sinking fund requirements required by the Act have not been complied with. Mr. G. T. Clarkson, in the audit of the Commission's accounts for the year ending October 31st, 1919, states:

"All sinking funds paid to the Commission have under the Act to be invested in securities of the Province of Ontario, but with the purchase price of the shares of the capital stock of the Ontario Power Company paid in bonds of the Commission, guaranteed by the Province, question arises as to whether such securities shall be retained by the Commission or must be transferred to and held by the Treasurer of the Province."

A further deviation has been made recently in respect to sinking funds in the agreements executed between the Hydro-Electric Power Commission and the municipalities of Port Arthur and Fort William. This is described in Section "G," page 145.

4. Renewal Reserves:

The Power Commission Act requires the Hydro-Electric Power Commission to set aside renewal reserves, which from time to time shall be used to replace obsolescent works and equipment. The renewal reserves set aside by the Commission vary for each class of property against which they are applied and, therefore, have different values for each of the several systems. The values used by the Commission, as stated by Mr. Gaby in Section "A" are:

Niagara System.....	21.2%
Severn System.....	2.75%
Wasdell's System	2.0%
Muskoka System.....	2.5%
Eugenia System.....	2.7%
Thunder Bay System	3.5%
St. Lawrence System	3.0%
Rideau System.....	1.8%
Thorold System.....	3.5%
Central Ontario System:	
Power & Transmission.....	2.5%
Local & Distribution.....	3.5%

Mr. Gaby further states that renewal reserve rates applicable to the distribution systems of municipalities are as follows:

Toronto	3.25%
Hamilton, London, Kitchener, St. Catherine, and all other cities on any of the systems.....	3.5%
Towns and villages on all systems.....	4%

These rates for the renewal reserves appear to be considerably lower than those stated by Sir Adam Beck before the Water Power Committee of the House of Representatives of 1918, during which he stated:

"MR. LENROOT: You say it includes 1.8% on indebtedness to amortize it in 30 years?

"SIR ADAM BECK: Yes; we also set aside 5% for depreciation.

"MR. HAMILTON: And you transmit power to the municipalities for \$18.00 a horsepower delivered to the municipalities, and that \$18.00 is intended to cover, first, the cost of production and transmission; second, maintenance; third, depreciation; fourth, amortization?

"SIR ADAM BECK: Yes, depreciation is amortization. The sinking fund is amortization."

The Power Commission Act requires that sinking funds shall be improved at the rate of 4% per annum, which is the rate of improvement used against all other classes of reserves.

Accumulated renewal reserves are invested in the properties operated by the Hydro-Electric Power Commission, or in those of the municipalities, depending against which class of property the reserve has been set aside, and the difference in the balance sheet between the fixed assets and the fixed liabilities in the form of advances from the Province or of debentures issued by the Commission represents the investments of accumulated renewal reserves in the properties of the Commission.

Mr. Pierdon states that it is the policy of the Commission, in so far as possible, to invest the renewal reserve in such classes of property as office buildings, service buildings, storehouses, etc., which are applicable to the entire works operated by the Commission rather than to any of the specific systems.

The accumulated renewal reserves, as shown in

the 1920 balance sheet, are \$2,352,938, not inclusive of those for office and service buildings, which total \$75,179. Of the total renewal reserves contributed by the municipalities, \$1,837,263 was contributed by the municipalities of the Niagara System, which is 78% of the total contributed by municipalities.

5. *Contingent Reserves:*

The Commission sets aside annually a contingent reserve, which Mr. Gaby states was based upon an arbitrary amount of about 25c per horsepower purchased. Unusual expenses due to catastrophes and other causes are met from this contingent reserve, which in the balance sheet for 1920 stood at \$65,102.

The contingent reserve has also been built up by crediting it with profits from power sold directly by the Commission to industrial companies. The Hydro-Electric Power Act states that the cost of power to the municipalities shall be credited with any profits accruing from contracts entered into between the Commission and companies, and, likewise, it shall be debited with any losses resulting from such contracts. However, in order to build up the contingent reserve to an amount which is adequate for the purposes of the Commission, the profits accruing from the sale of power directly by the Commission to such companies, have, in general, been charged as an expense and have been credited to the contingent reserves.

6. *Cash Reserves:*

The total reserves of the Hydro-Electric Power Commission are comprised of the sinking fund, renewal, contingent, and cash reserves.

Accumulated Sinking Funds as of Oct.

31, 1920, were	\$907,621
Those for Renewals were.....	2,432,117
Those for Contingencies were.....	65,102

making a total of..... \$3,404,840

In addition the Commission held cash reserves to the extent of..... 550,495

making the total reserves..... \$3,955,335

The Sinking Fund Reserves are invested in the securities of the Province of Ontario, as required by the law, while those for renewals and contingencies are invested in the works of the Hydro-Electric Power Commission.

7. *Taxes:*

The Commission does not charge taxes as an item of the cost of power, except those taxes levied against the lands owned by the Commission. The same policy is pursued by the municipalities in respect to their distributing systems. Relief from taxes is estimated to amount to approximately \$424,102 in the case of the power plants and transmission systems of the Commission, and \$299,000 in the case of the distribution systems owned by the municipalities.

making a total of \$723,102. This is the amount after holding taxes paid by the Ontario Power Company, the Commission and the municipalities for the year of 1920.

The action of the Commission in respect to the Ontario Power Company; the action of the Provincial Legislature in respect to the water power licenses and the expressions of municipal Hydro-Electric Power Commissioners with regard to the taxes is discussed later in this section under the heading of "The Real Cost of Power to Those People in Ontario Using Hydro-Electric Power Service for the Year Ending 1920."

General Expenses:

General expenses against the operations of the Commission consist of such items as general office and engineering expense, and service expense assignable to specific accounts or systems. The method of the Commission to provide for the distribution of this class of expense until about a year ago was to charge the full rate of these expenses in proportion to the amounts of salaries and wages expended on the different accounts of the several systems. However, due to the proportionally large amounts expended for salaries and wages on the Queenston-Chippawa Development, the use of such a method appeared to make this method of distribution inequitable and, on June 20, 1921, Mr. W. G. Pierdon, Accountant for the Commission, recommended a different method for procedure, which is outlined in a memorandum to the Commission as follows:

June 30, 1921.

SIRS:

Distribution of General Administrative Office Expense

The Commission's present method of writing off this class of expense (which now approximates \$70,000 per month) is on the basis of its proportion to the total monthly engineering and labor costs of every undertaking, whether Operation or Capital.

Under normal conditions the method proves to be equitable, but when such heavy labor and engineering charges as pertains to the Niagara Development Works are applied, an unequal division of the expense occurs, resulting in this particular job absorbing an unfair share and thus lowering the charges against operations and other accounts. The unfairness of this method of distribution is becoming increasingly apparent month by month, until what was considered a reasonable expense against operations in respect to general expense, say 8% to 10%, has dropped to less than 5%. The resulting effect being a charge against the Development Works out of proportion to the benefits received and giving unwarranted relief in the various Systems' operating expenses.

After a thorough review of the condition, with the assistance of the Chief Engineer, I beg to recommend that, with the exception of the

Niagara Development Works, each of the Commission's operations be required to assume a sum equivalent to 10% of their engineering and labor charges, as representing each one's share of General Expense, and that the Development Works assume the balance of General Expense Account approximating \$32,000 per month, an amount which compares closely with the charges per month for last year.

This recommendation, if approved, to take effect as from November 1, 1920, and to continue until completion of the Niagara Development Works.

Pending approval of this recommendation, I have taken the liberty of applying this method of distribution to all Operating Reports for this year which have been submitted to the Commission.

Attached you will please find details of General Expense account for the month of May, also statement of labor and engineering charges against all the Commission's Works.

Respectfully submitted,

(Sd.) W. G. PIERDON, *Accountant*.

To: Col. Sir Adam Beck, K. B. Chairman, and Commissioners.

The effect of Mr. Pierdon's recommendation on the apportionment of general expense against the Niagara Power Development may be seen by comparing the months of June, 1921, when the expenditure on salaries and wages on the Niagara Power Development was \$1,593,222, to that for the month of September, 1921, when the expenditure for salaries and wages on the Niagara Power Development was \$504,847. In the first instance, the proportion of general expenses charged against the Development was \$38,597, which is approximately 2.4% of the cost in salaries and wages, while that for the month of September was \$34,212, which amounts to approximately 8.4% of the expenses in salary and wages. During the same months all other construction and operating accounts were charged with 10% of their salary and wage accounts for general expense. It is evident from these figures that the apportionment of general expenses used by the Commission is equitable.

9. Expenses Charged Directly Against the Province of Ontario:

The Hydro-Electric Power Commission, each year, makes certain direct charges against the Province of Ontario. These amounted to \$202,537 for the fiscal year ended October 31, 1919, and \$226,551 for the fiscal year ended October 31, 1920. The details of such expenditures for the latter fiscal year are given in Table No. 13.

Of the expenditures charged directly against the Province in 1920, the item of engineering work done for non-operating municipalities, estimates, surveys, and demonstrations for rural districts, and the excess of expenditures over receipts on electrical inspection would, if these properties were privately

operated, be properly charged to promotion and new business.

The item for general hydrographic surveys and for engineering investigations, surveys and reports under the Water Power Regulation Act are properly chargeable against the Province in the same manner as the expenses for the Dominion Water Power Branch of Canada or the Geological Survey of the United States are chargeable against governmental operations in those respective countries.

The item of \$121,917 for preliminary surveys on the St. Lawrence River is purely a promotion expense, and eventually should be capitalized when the development of the St. Lawrence River is undertaken. The Commission in the past has charged like expenses for investigations on the Niagara River against the Province, but upon the decision to go into the Queenston-Chippawa project these expenses were capitalized and are now borne as a portion of the cost for that development.

TABLE NO. 13

DIRECT CHARGES BY THE HYDRO-ELECTRIC POWER COMMISSION AGAINST THE PROVINCE OF ONTARIO FOR THE FISCAL YEAR OF 1920.

Engineering assistance to non-operating municipalities and districts for gathering of data for statistical purposes; estimates for supply of power and rate investigation.....	\$31,071.81
General Hydrographic Surveys, Storage Surveys, Reports and Investigations on Power sites, and stream flow, and special hydrographic investigations and reports	11,001.96
Electric Railway Engineering Investigations, Surveys, By-laws and reports under Hydro-Electric Railway Act 1914.....	13,121.96
Engineering Investigations, Surveys and Reports under Water Powers Regulations Act 1916	9,135.77
Preliminary Surveys on the St. Lawrence River between Morrisburg and the head of the Galops Rapids, covering both Hydrographic and Topographic features	121,916.91
Estimates, Surveys and Demonstration in Rural Districts.....	20,879.99
<i>Electrical Inspection:</i>	
Salaries and expenses of Inspectors; expense of local offices and administration	\$208,453.48
Revenue from Inspection Fees.....	189,030.88
	\$19,422.60
TOTAL.....	\$226,551.00

The Central Ontario System

The Central Ontario System was purchased by the Province of Ontario in 1916 for a price of \$8,350,000 in 4% bonds of the Province of Ontario, redeemable in 1926. Since the date of the purchase, debentures to the extent of \$225,000 have been issued for the purchase of pulp-wood areas in Bruntion Township, and cash advances of \$3,598,185 have been made to the Hydro-Electric Power Commission, bringing the total of fixed liabilities of the System as of October 31, 1920, up to \$12,173,185.

The System, at the time of the purchase, comprised 22 companies, and consisted of electric power and light systems, gas works, electric street railways, water works and a pulp mill.

The balance sheet for the fiscal year of 1920 shows an accumulated operating deficit of \$167,531, but for the year 1920 there was an operating surplus of \$136,716. The only provision for sinking fund found within the expenses for the fiscal year of 1920 was \$537 under the subdivision of utilities, while the balance sheet shows an accumulated sinking fund account amounting to but \$21,216 since the purchase of the property.

In operating this property as the trustee for the Province, the Hydro-Electric Power Commission has evidently taken advantage of the provision in the Hydro-Electric Power Commission Act providing for the deferment of sinking funds for five years after the properties were purchased, and as the bonds issued in payment for these properties have a life of only ten years from the date of issue, these will have to be refunded upon their due date.

Mr. Pierdon states that the renewal reserve used for the Central Ontario System amounts to 2.5% on generating stations and transmission lines, and to 3.5% on local utilities. Under these rates of reserves \$194,000 was set aside during the fiscal year of 1920, resulting in an average rate of 2.7%. If the amount of renewal reserves thus set aside were capitalized at the average rate, they would show an investment in physical property of \$7,200,474 as compared to the total physical assets of \$10,604,853. It therefore seems that in purchasing this system the Province paid about \$3,200,000 for such intangible assets as water rights, franchises, good-will, contracts, etc. In other words, about 62% of the purchase price represented the value of the physical properties received, while approximately 38% represents the values of the intangibles.

Essex County System

The Essex County System comprises a number of municipalities at the western end of the Niagara System which formerly were served by a private company purchased by the Hydro-Electric Power Commission through the issue of Hydro-Electric Power Commission debentures to the extent of \$226,000.

In the annual adjustment made by the Commission, the Essex County System is considered as a company to which power is sold by the Commission,

inasmuch as the municipalities to which this power is sold have not, as yet, assumed any of the indebted-
11088 The Hydro-Electric Power Commission is selling the power directly to the ultimate consumer.

The balance sheet for this system shows the fixed liabilities of the Commission, at the end of the fiscal year of 1920, to be \$374,985, and also shows an accumulated deficit of \$40,786 for the operation of the System from the time of its purchases up to the end of the year under consideration.

The revenue and expense statement shows an operating deficit of \$8,804 for the year 1920. Under the cost of operation the provision for renewals is \$12,759, and if this were capitalized at 3.5% as the renewal rate it would show the value of the physical property to be about \$365,000, which is approximately what the balance sheet indicates. It is apparent, therefore, that in this instance, unlike the case of the Central Ontario System, the Ontario Power Company and the Thorold System, the Commission did not pay large amounts of money for intangibles.

From the data given in the Commission's Annual Reports, it is impossible to determine the average cost per horsepower-year to the ultimate consumer on the Essex System for 1920, inasmuch as the average horsepower purchased for the Essex System is not segregated from that of other companies to which the Hydro-Electric Commission sells power.

The Thorold System

The Thorold System was formerly known as the Battle System, and operates in the Municipality of Thorold, which is located not far from Niagara Falls. The Hydro-Electric Power Commission acquired the Thorold System soon after it purchased the Ontario Power Company, paying therefor \$100,000 in bonds of the Commission.

Its balance sheet shows the value of the physical assets, including transmission and distribution lines, contracts, franchises and good-will, to be \$100,773, and there is also shown on the liability side an accrued operating surplus of \$13,602.

Under Operating Accounts a surplus of \$9,210 is shown for the year 1920, while a provision for the renewal fund amounts to \$933. Mr. Pierdon states that the renewal rate employed on this property is 3.5% of the physical value of the property, which indicates the tangible physical assets to be about \$27,000 out of the purchase price of \$100,000. In other words, the Hydro-Electric Power Commission in purchasing this property paid about 73% of the total price for such intangibles as contracts, franchises and good-will, which are listed among the fixed assets.

Another item deserving attention is shown under revenue. This shows the Commission received royalties to the extent of \$3,511 from the Ontario Power Company on power sold by the latter to power customers in the Thorold District. Previous to the purchase of the Ontario Power Company, or of the Thorold System, by the Commission, the Ontario Power Company placed lines in the Thorold District in competition with those of the Battle

System, which system had an exclusive franchise to serve Thorold, and as a result of the controversy brought about by this competition the Ontario Power Company agreed to pay to the Battle System a royalty for each horsepower it sold within the municipality of Thorold. Since the assumption of ownership of both the Ontario Power Company and the Thorold System of the Commission, the Commission has continued the practice of charging royalties against the Ontario Power Company and crediting these royalties as revenue to the Thorold System.

It is understood that the Municipality of Thorold has approached the Commission with a view toward taking over the Thorold System, but, up to date, no understanding has been arrived at as to the price which the municipality shall pay the Commission for the System.

It is also understood that for the fiscal year of 1921 the operation of the Thorold System was extremely profitable, and will result in a surplus about equal to the operating expenses for the System. In discussing with Mr. Pierdon what would become of the accrued operating surplus from the Thorold System, should it be purchased by the Municipality of Thorold, he stated that this would be credited to the operations of all of the municipalities on the Niagara System, reducing by a like amount their operating cost for the year when credit is given. Such a distribution of the surplus, if it should be so disposed of, does not seem equitable in accordance with the provisions of the Power Commission Act, where each municipality must stand its proportional part of the cost, as the municipalities other than Thorold have in no sense been instrumental in the accumulation of this large surplus.

The Real Cost of Power to Those People in Ontario Using Hydro-Electric Power Service for the Year Ending 1920

1. The Real Cost of Wholesale Power to the Municipalities.

The law under which the Commission operates requires that it pay taxes against land only, and the taxes paid by the Hydro-Electric Power Commission and by the municipalities are but a very small part of those which would have been required to be paid were these properties operated under private management. This relief from taxes lowers the cost of power to the consumer, but, on the other hand, the loss of taxes which would have been gained were the properties privately operated must be met by the general taxpayer, whether he be a customer taking Hydro-Electric Power Service or not.

Since the control of the Ontario Power Company has rested in the Commission, it has continued to pay taxes and water rentals on that property, but not without protest. By a recent decision rendered by the Ontario Railroad Commission, the Ontario Power Company has been relieved of the necessity of paying taxes for this property. Whether this decision will stand when taken to a higher court by the Municipality of Niagara Falls, Ont., is to be seen.

On the other hand, by the legislation enacted by the Provincial Legislature during 1920-1921, relative to the supply of power to rural lines, rentals will be charged for water power whether developed by government or by private interests. Thus it appears there are two distinct policies with regard to taxes and licenses within the Province.

In respect to the taxes paid by the municipalities on their distribution systems, there appears, in some quarters, a belief on the part of the Municipal Hydro-Electric Commissioners that all municipal electric utilities should pay their own way, as was stated by Mr. P. D. Ross, of the Municipal Hydro-Electric Power Commission of the city of Ottawa, in the *Ottawa Morning Journal* of August 23, 1921.

The Power Commission Act provides that a sinking fund shall be established through which capital invested in government electric utility properties will be repaid at the end of thirty-five years, making the properties at that date free from debt, and it further requires the setting aside of renewal reserves, which shall provide for the replacement of works as they become obsolescent. The sinking fund requirement, by the terms of the Act, requires an annual payment of 1.78%, with a 4% improvement of the invested capital, while the reserves for renewal vary with the character of the different systems, and have been previously stated.

In estimating what the real cost for power would have been were the same cost elements employed by the Commission as by private companies, sinking funds have been eliminated, as they come under the class of financial arrangements, and, instead, an amount adequate for renewal reserves to provide for obsolescence is stated in Table No. 14.

This renewal reserve was based upon the rates used for the Superpower Report, but with an improvement of 4% per annum, as required by the Law of Ontario, instead of 7% per annum, as used in the Superpower Report. The renewal rates in the Superpower Report were arrived at after consultation with the foremost authorities on this subject in the United States.

The Hydro-Electric Power Commission makes certain charges directly against the Province of Ontario, as has been brought out previously. Of these charges against the Province of Ontario, those representing engineering for non-operating municipalities, estimates, surveys and demonstrations for rural districts, and the excess of expenditure over receipts for electrical inspection, amounting to \$71,394, are properly chargeable against promotion and new business, if the same cost elements are used in the accounting for the government electric utilities as those for private companies.

In Table No. 14 the real wholesale cost of power delivered by the Hydro-Electric Power Commission to the municipalities is compared to the apparent cost for power, shown in the 1920 Annual Report of the Commission, and this table shows an excess of \$678,321 in the real cost over that of the apparent cost published for the systems compared.

The apparent unit wholesale cost for power purchased by the municipalities, as shown in Table No. 6, was \$22.60 per horsepower-year for 1920, as compared to the real unit cost of \$26.50 per horsepower purchased. There is, therefore, an increase of 17.3% in the real wholesale cost for power to the municipalities over that stated in the annual report of the Commission.

Under the "Real Wholesale Cost for Power," the Renewal Fund, as computed in the table on the next page, amounts to \$1,283,633, from which has been deducted \$389,534, which was set aside for such purpose by the Ontario Power Company and which accordingly is included in the first item. The taxes of \$99,450, stated by Mr. Pierdon to have been paid by the Ontario Power Company, are deducted from item 1 and are shown under item 6.

TABLE NO. 14
THE WHOLESALE COST OF POWER TO THE
MUNICIPALITIES PURCHASED FROM THE
HYDRO-ELECTRIC POWER COMMISSION
FOR THE FISCAL YEAR 1920

	The Real Wholesale Cost of Power to the Municipalities	The Apparent Wholesale Cost of Power to the Municipalities from the Annual Report of H. E. P. C.
1. Production Cost of Power....	\$2,131,306	\$2,158,015
2. Operation, Maintenance and Administration	746,291	764,183
3. Interest	891,498	891,498
4. Renewal Reserve	894,099	478,056
5. Sinking Fund		233,218
6. Taxes	578,000	109,297
Charged against Province:		
7. (a) Engineering for non-op- erating municipalities..	31,072	
8. (b) Estimates, Surveys, etc., rural districts.....	20,880	
9. (c) Excess expenditures over receipts for underwrit- ing inspection	19,442	
10. Total	\$5,312,588	\$4,634,267
11. Credits from power sales to industrial companies	634,105	634,105
	\$4,678,483	\$4,000,162
12. Credit for profits from power sales to industrial companies.	2,897	2,897
	\$4,675,586	\$3,997,265
13. Horsepower purchased by the municipalities	176,430	176,430
14. Cost per horsepower year pur- chased	\$26.50	\$22.60

2. The Real Retail Cost of Power to Customers of the Municipalities

Because the municipalities close their accounts for the fiscal year ending December 31st rather than for October 31st, as does the Hydro-Electric Power Commission, the real retail cost for power to the ultimate consumer must be taken as of December 31st.

The real unit wholesale cost for power shown in Table No. 14 was \$26.50 per horsepower purchased, and this, when applied against the 180,931 horsepower purchased for the municipal fiscal year, results in a total cost of \$4,800,000 for the wholesale power purchased.

TABLE NO. 15
RETAIL COST OF POWER TO THE ULTIMATE CONSUMER PURCHASING POWER FROM MUNICIPALITIES TAKING HYDRO-ELECTRIC POWER SERVICE FOR THE FISCAL YEAR 1920

1. Cost of Power Purchased from Commission	\$4,800,000	\$4,079,000
2. Administration, Operation and Maintenance	2,341,712	2,337,187
3. Interest	1,390,543	1,390,543
4. Taxes	1,231,633	878,862
5. Taxes not contained in Item 2.	299,000	
6. Total	\$10,104,888	\$8,685,592
7. Apparent Surplus for 1920....	670,974	670,974
8. Total Cost to Ultimate Consumer		
Surplus as reported for 1920....	\$10,775,862	\$9,356,566
9. Horsepower Purchased by municipalities for their fiscal year	180,931	180,931
10. Average cost per horsepower to Ultimate Consumer	\$59.50	\$51.60

The same principles have been used for determining the real retail cost of power to the ultimate

consumer as were applied under wholesale costs, and taxes and a proper charge for renewal reserves have been included. In respect to retail costs, no tax item appears as such in Table No. 15, under the column for the apparent costs, as the cost of taxes are there charged against administration, operation and maintenance, and are contained within the amount for that item.

Table No. 15 shows the comparison of the real retail cost for power to the customers of the several municipalities compared to the apparent cost stated in the annual reports of the Hydro-Electric Power Commission for 1920. The total real retail cost to the ultimate consumer for the systems considered is \$10,775,862, while the apparent retail cost from the annual reports of the Commission is \$9,356,566. The real retail cost for 1920 is, therefore, greater by \$1,419,296 than the apparent retail cost, which is 15.3% of the latter.

While the increase of real retail cost over the apparent cost from the Commission's 1920 report is greater in total than for the wholesale costs for power, the percentage of the increase is greater for the wholesale costs, due to the municipalities having set up larger renewal and sinking fund reserves for the distributing systems.

The real unit retail cost for power per horsepower-year purchased from the municipalities is \$59.50, while the apparent retail cost from the annual report of the Commission is \$51.80, which shows the real unit cost to be \$7.70 per horsepower-year purchased in excess of the apparent costs. Assuming the load factor of the region served by Hydro to be as high as that for the Superpower Zone in the United States, the real average cost of power to the ultimate consumer in Ontario receiving such service would be 2.33 cents per kw-hr., delivered.

SECTION E—(PART II)

INDEBTEDNESS, ASSESSMENTS AND TAXES IN THE PROVINCES OF ONTARIO AND QUEBEC

A Comparison of the Municipal Statistics for the Provinces of Ontario and Quebec

The Dominion Bureau of Statistics publishes for each year the several pertinent facts with regard to municipal operations throughout the Dominion of Canada. These are divided between two publications, one covering urban municipalities having a population of 3,000 to 10,000, and the second, urban municipalities having a population of greater than 10,000. Figures have been prepared from these statistics showing compulsory taxes, balanced taxes and ordinary expenses, both in dollars per capita and in mills per dollar of assessed valuation. In addition to this, Table No. 16 gives much greater detail as to these items and also as to revenues and sinking funds.

The term "balanced tax" is used to express the tax rate that would have been required to have covered the deficit between ordinary revenue from

sources other than taxation, and ordinary expense. In other words, tax rates must be based on estimates, and these estimates may be either too high or too low, giving a tax rate which is not entirely representative of the difference between revenue from other sources than taxes and expense, unless it is averaged over a period of years. "Ordinary expenditure," as used, includes all expenditures with the exception of debentures or bonds and overdrafts, in addition to a few small miscellaneous items, while "ordinary revenue," used in the table, includes all the revenues of the municipality with the exception of revenues from debentures or bonds and a few small miscellaneous items.

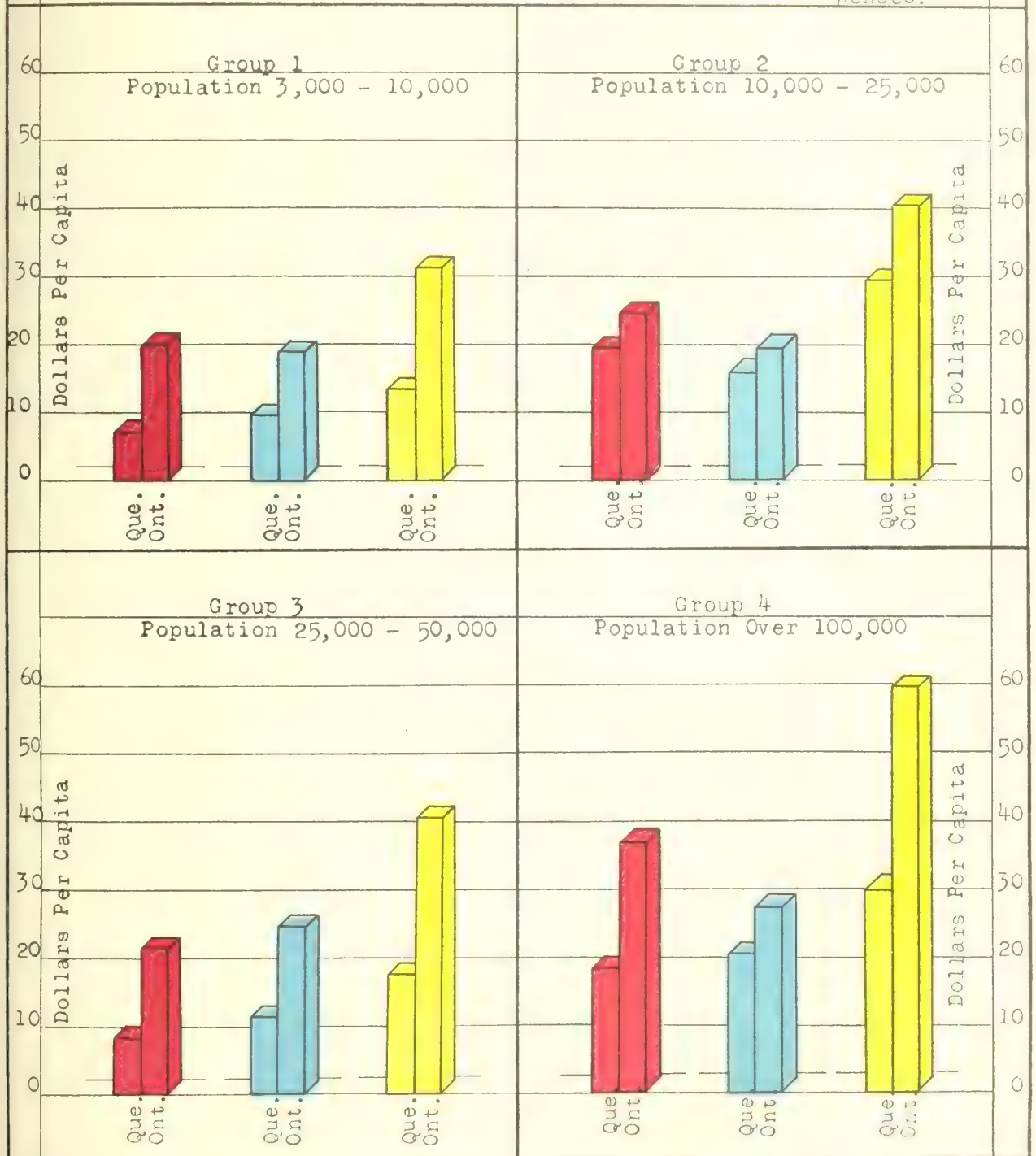
Figures Nos. 11 and 12 show that for all municipalities having a population of 3,000, or greater, the taxes and ordinary expenses of municipalities for the Province of Quebec are very much lower than those for the Province of Ontario, and an inspection of these figures will show that in certain of the groups both the taxes and the ordinary expenditures are at least twice as great in the Province of Ontario as in the Province of Quebec.

Figure 11

Taxes and Expenses compared for the Provinces of Quebec and Ontario in 1919 as derived from the report of the Dominion Bureau of Statistics - Per Capita basis.

Legend:

■ — Compulsory Taxes, ■ — Balanced Tax, ■ — Ordinary Expenses.



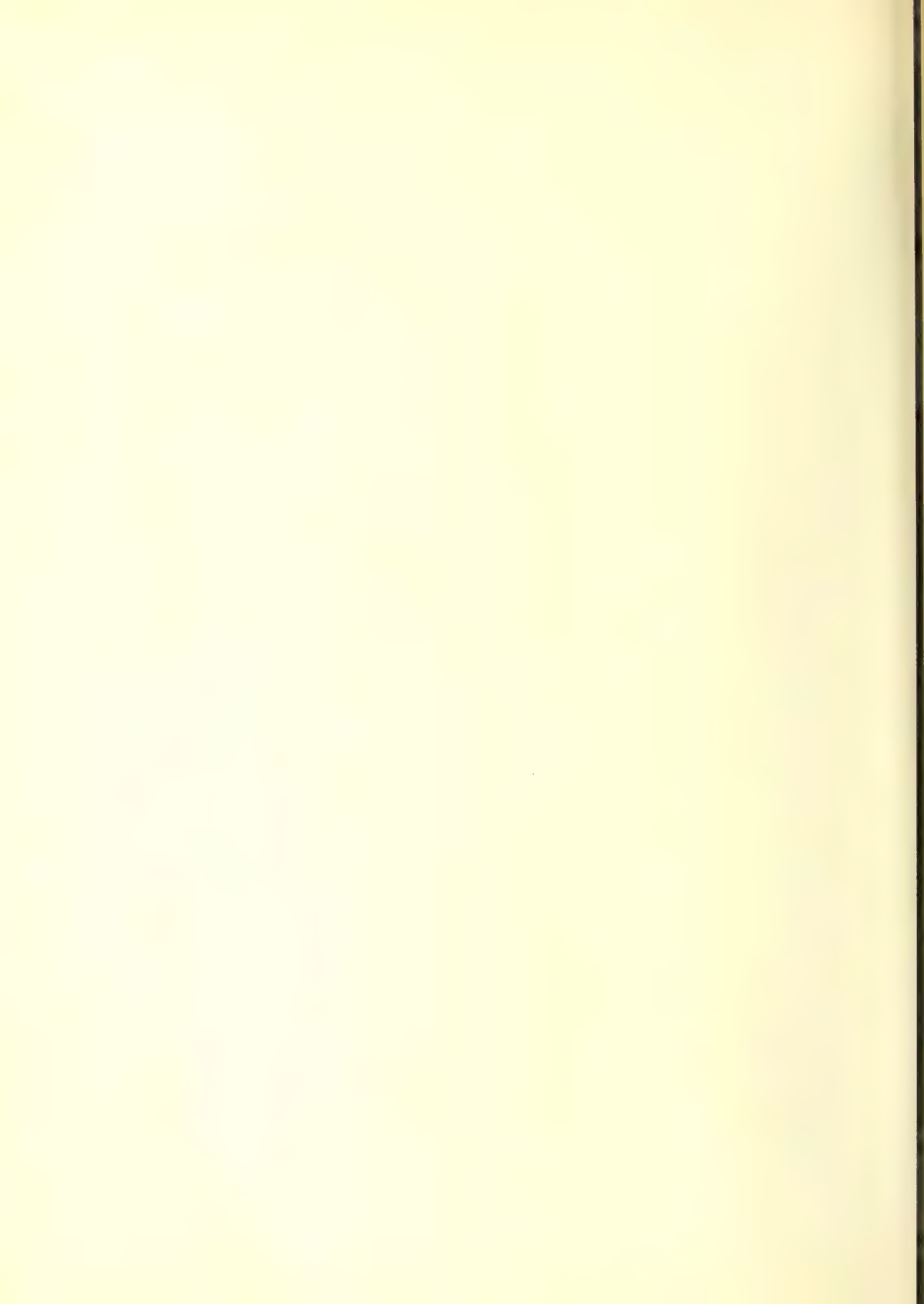
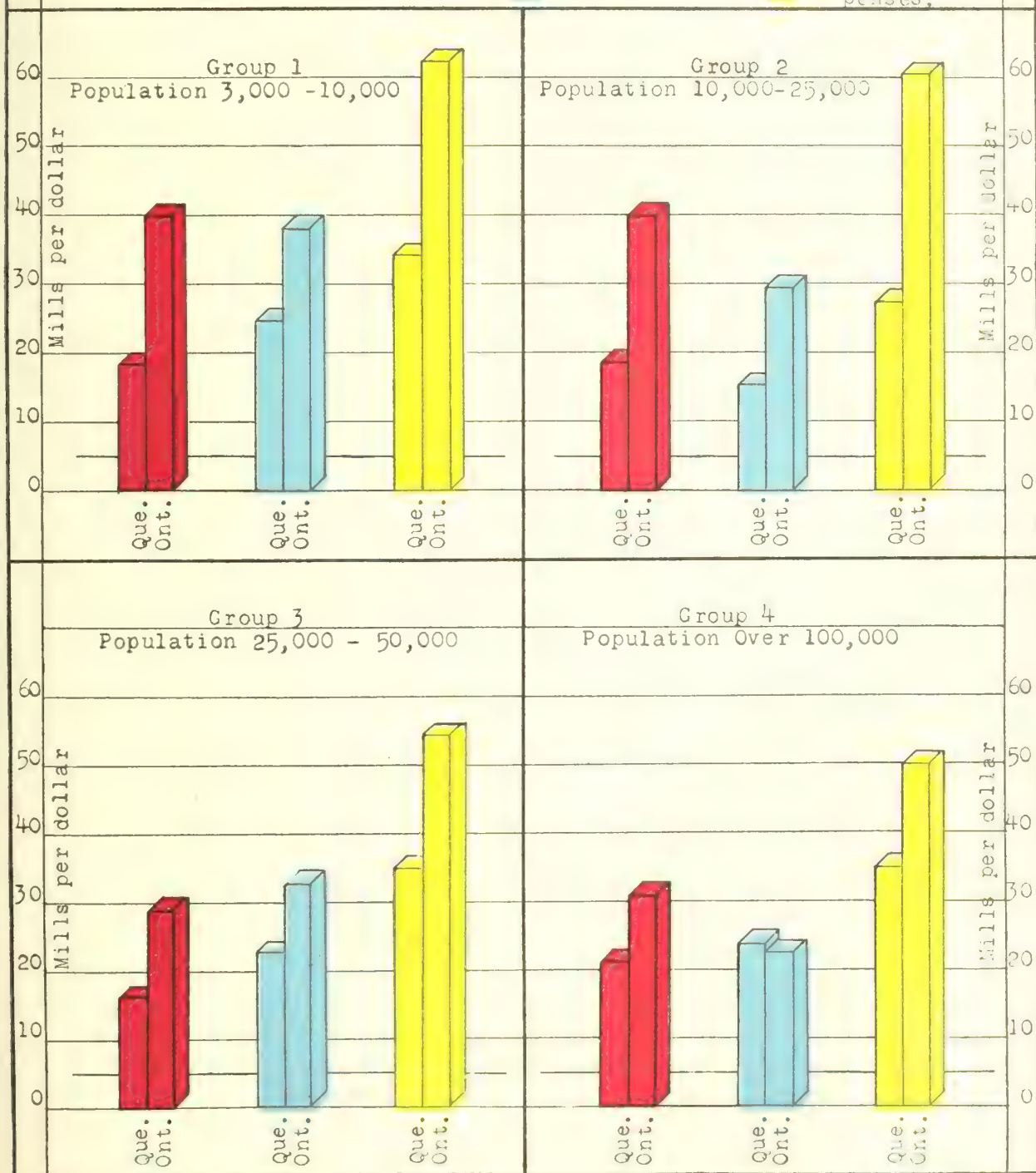


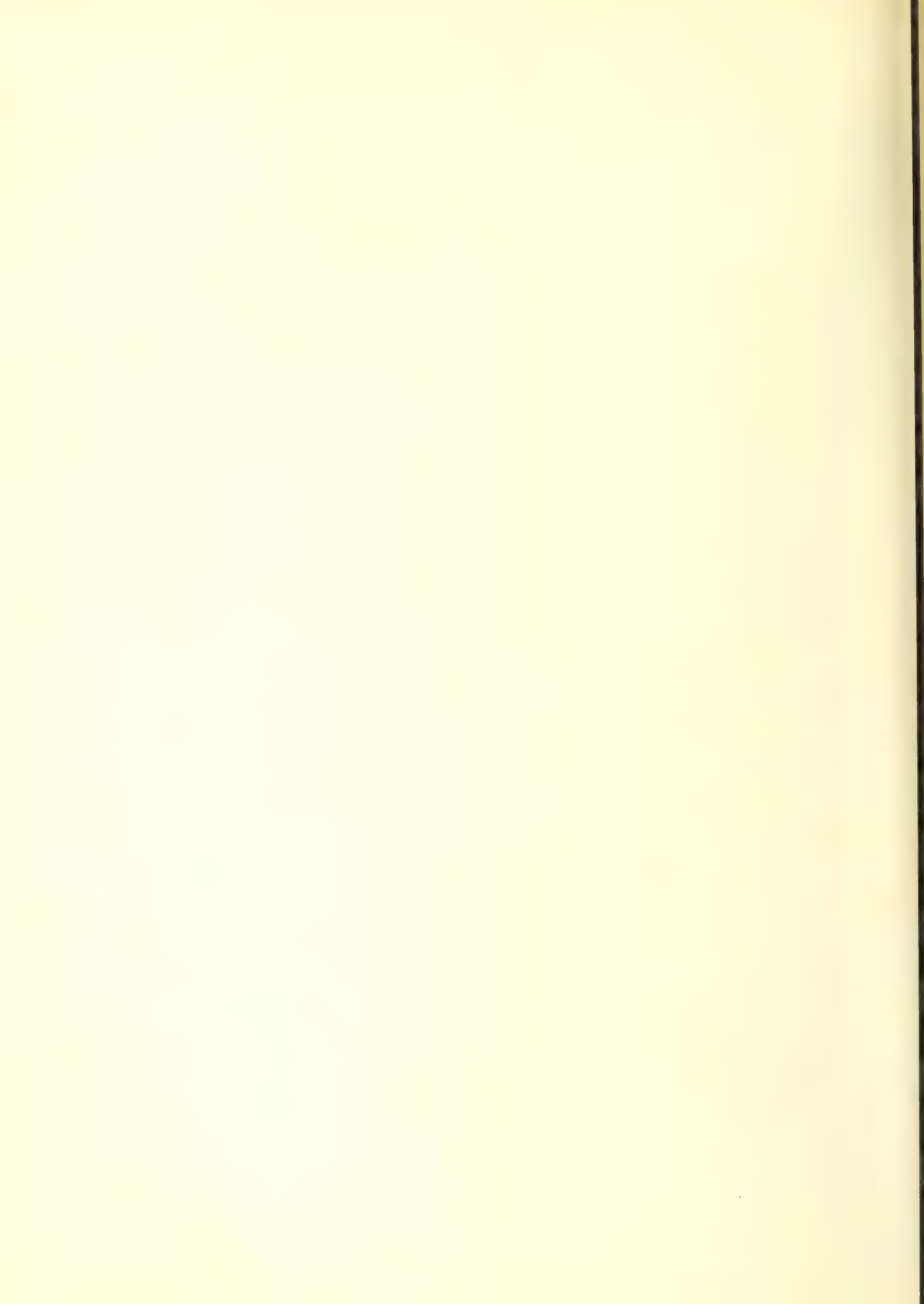
Figure 12

Taxes and Expenses compared for the Provinces of Quebec and Ontario in 1919 as derived from the report of the Dominion Bureau of Statistics - Mills per dollar of taxable property.

Legend:

■ - Compulsory Taxes, ■ - Balanced Tax, ■ - Ordinary Expenses.





Referring to Table No. 16, it will be seen that the taxable property per capita in the Province of Ontario is in each instance very much higher than that for Quebec. This may be due in some extent to the fact that Ontario is more of an industrial province than is the Province of Quebec, but it can hardly hold true for cities of over 100,000 people to the extent shown in the table, and it is probable that a higher rate of assessment on property is used in Ontario.

There is not a great deal of difference in the bonded debt per capita between the two provinces, and, when expressed as a per cent of the taxable property, the bonded debt for Ontario is lower than for Quebec for the majority of the groups. It is also seen that while the municipalities in the Province of Ontario are spending money at a much higher rate than are those for Quebec, they are also setting aside greater sinking funds for the retire-

ment of debt than are the municipalities in the Province of Quebec.

The statistics shown for Quebec are for a total population of 1,135,845, while those for Ontario are for 1,322,262, the difference between the two populations being about 15%.

For all of the cities analyzed, that is, for thirty-five municipalities in Quebec and sixty-six municipalities in Ontario, the assessed valuation per capita for Ontario is 18.6% higher than that for Quebec, while the bonded debt per capita is about the same in each instance. The compulsory taxes per capita for Ontario, however, are 86.5% higher than are those for Quebec, while they are 57% higher in mills per dollar. This large difference is reduced somewhat in the balanced taxes, Ontario being 33% higher than Quebec per capita and 15% higher in mills per dollar.

The greatest difference between the municipal

TABLE NO. 16
COMPARATIVE STATISTICS FOR MUNICIPALITIES IN PROVINCES OF QUEBEC AND ONTARIO
(Derived from publications of the Dominion Bureau of Statistics for 1919)

	Cities Over 100,000		From 50,000 to 100,000		From 25,000 to 50,000	
	Quebec	Ontario	Quebec	Ontario	Quebec	Ontario
Number of cities	2	3		1	3	2
Aggregate population	821,150	715,153		59,100	81,824	64,629
Taxable property—Total \$1,000.....	696,859	850,439		40,783	40,908	48,673
Per Capita—Dollars	849	1,190		691	505	753
Bonded debt—\$1,000.....	134,427	133,083		7,381	9,227	7,154
Per Capita—Dollars	164	187		125	113	111
Per cent bonded debt to taxable property—percent	19.3	15.6		18.1	22.5	14.7
Compulsory taxes—Total \$1,000.....	14,727	26,224		948	674	1,406
Per Capita—Dollars	18.00	36.90		16.05	8.25	21.78
Average tax rate—mills per dollar.....	21.1	30.9		23.2	16.4	28.9
Total ordinary receipts—\$1,000.....	22,527	49,263		2,592	1,195	2,454
Total Ordinary Expenses—\$1,000.....	24,426	42,500		2,883	1,455	2,641
Excess receipts over expenses—\$1,000.....	1,899	6,763		291	260	187
Net sum required by taxation—\$1,000.....	16,626	19,461		1,239	934	1,593
Per Capita—Dollars	20.20	27.20		20.90	11.41	24.65
Net tax rate required to balance receipts and expenses—Mills per dollar.....	23.9	22.8		30.3	22.8	32.75
Total ordinary expenses per capita—dollars..	29.80	59.50		48.70	17.70	40.90
Per dollar of taxable property—Mills..	35.1	50.0		70.6	35.60	54.20
Total sinking fund.....	1,959	4,704		101	120	73
Per cent of sinking fund to bonded debt....	1.45	3.54		1.37	1.30	1.02
Sinking fund in mills per dollar of assessed valuation	2.81	5.50		2.52	2.93	1.02

	From 10,000 to 25,000		From 3,000 to 10,000	
	Quebec	Ontario	Quebec	Ontario
Number of cities.....	6	15	24	45
Aggregate population	91,774	254,246	141,097	229,134
Taxable property—Total \$1,000.....	96,706	169,833	55,304	115,625
Per capita—Dollars	1,155	668	392	505
Bonded debt—Total \$1000.....	13,236	34,664	9,365	15,557
Per capita—Dollars	145.50	136.50	66.50	68.00
Per cent bonded debt to taxable property—Per cent.....	13.70	20.40	16.9	13.5
Compulsory taxes—Total \$1,000.....	1,782	6,263	1,008	4,599
Per capita—Dollars	19.40	24.60	7.10	20.00
Average tax rate—Mills per dollar.....	18.4	36.8	18.10	39.9
Total ordinary receipts—\$1,000.....	2,998	11,613	1,886	7,218
Total ordinary expenses—\$1,000.....	2,676	10,312	2,239	6,983
Excess receipts over expenses—\$1,000.....	322	1,301	353	235
Net sum required by taxation—\$1,000.....	1,460	4,962	1,361	4,364
Per capita—Dollars	15.90	19.60	9.68	18.95
Net tax rate required to balance receipts and expenses—Mills per dollar	15.10	29.20	24.80	37.8
Total ordinary expenses per capita—Dollars.....	29.10	40.60	13.50	31.60
Per dollar of taxable property—Mills.....	27.60	60.50	34.20	62.5
Total sinking fund.....	164	925	320	1,085
Per cent of sinking fund to bonded debt.....	1.24	2.67	3.41	6.97
Sinking fund in mills per dollar of assessed valuation....	17.0	26.7	5.8	9.4

statistics of the two provinces appears in the total ordinary expenses, which are 82% greater per capita and 54% greater in mills per dollar for Ontario than they are for Quebec. While the debt for Ontario is larger than that for Quebec, Ontario, at the same time, through sinking funds, is retiring her debt at a faster rate, the rate of retirement in Ontario being 130% greater than that for Quebec when taken in terms of the per cent of the sinking fund to the bonded debt, and about 95% greater in terms of mills per dollar of assessed value.

The summarized results of the municipal statistics for all the municipalities above 3,000 in population are:

TABLE NO 17
SUMMARIZATION OF MUNICIPAL STATISTICS
FOR ALL CITIES OF OVER 3,000 POPULATION
IN THE PROVINCES OF ONTARIO
AND QUEBEC FOR 1919

	Ontario	Quebec
Number of municipalities.....	35	66
Aggregate population	1,135,845	1,322,262
Taxable property, per capita.....	\$780.00	\$925.00
Bonded debt, per capita.....	\$146.50	\$149.50
Per cent bonded debt to taxable property	18.7	16.2
Total millage rates, per capita.....	\$16.00	\$20.80
Average compulsory tax rate, mills per dollar.....	20.5	32.2
Balanced tax, per capita.....	\$18.00	\$23.90
Balanced tax, mills per dollar....	22.5	25.9
Ordinary expenses, per capita....	\$27.10	\$49.30
Per cent of sinking fund to bonded debt	1.48	3.41
Sinking fund in mills per dollar of assessed valuation.....	2.89	5.62

The tax problem has become a serious one in Toronto, and, due to business taxes and the valuations made for assessment purposes, industries located in Toronto have protested against the high taxes being imposed. On August 15, 1921, the Sheet Metals Project Company addressed the Chairman of the Court of Revisions of Toronto with regard to the taxes against that property. The following quotations are taken from that letter:

"Our reason for appealing is because of the fact that our assessment with respect to buildings has more than doubled last year's, and we can see no reason for this.

"The general rate of taxation being 33 mills, 60% to be added to this would be 19.3 mills. Therefore the general and business taxes on a manufacturing industry in Toronto amount to 52.8 mills.

"The general tax rate in the city of Montreal on industries similar to our own is 23.5 mills, of which 10 mills is for schools, while in Toronto, the rate is 33 mills, 10 mills of this being the school rate, the same as in Montreal. Instead of our business tax in Toronto of 19.8 mills, Montreal's business tax rate is based on 8½% of the annual rental value, being equal to 4.8 mills or a total of 28.3 mills against Toronto's 52.8 mills. The duplicate tax to be estimated by the city on the business of 1920 amounts to at least a further 33.5 mills. The

policy of inflation, as well as more modern buildings, will amount to about 40 mills. Therefore, we have a taxation of about 28.3 mills in Montreal against 128.3 mills in Toronto, whereas the assessed values in Montreal are said to be generally lower than in Toronto. We append hereto a certificate by Messrs. Price, Waterhouse & Company as to the correctness of these figures."

In the annual debt statement issued by Finance Commissioner Ross for the city of Toronto, on September 9, 1921, Mr. Ross called attention to the very great increase in debt during the past year. Following are quotations from Mr. Ross's report:

"The increase in the gross debt will be the greatest for any single year in the history of the city. This comes as a result of two factors: First, the street railway acquisition, and second, the resumption of works postponed during the war and the critical period immediately following. There is a statutory limit placed by Legislature upon the amount of debt that the city can contract. At no time can it exceed a certain percentage of the assessment—12½% of the first \$100,000,000 and 8% of the balance. The 1921 assessment is \$693,483,354 and the statutory limit of debt is \$59,978,668. The gross debt less the exempted portion is \$40,319,170, so that at the close of the year the city's borrowing margin is \$10,659,498.

"The borrowing margin at present is not built on the soundest basis possible, for of the total assessment of \$683,000,000 approximately \$130,000,000 consists of business and income assessment. On the basis of real estate assessment the \$10,700,000 borrowing margin shrinks to the insignificant figure of \$260,000.

"With the assessment reform soon to go into force, it is estimated that \$50,000,000 will be cut off the total assessment with a resultant decrease of several millions in the limited debt.

"The Toronto Hydro Radial obligations are about \$8,508,861.

"It cannot be denied that heavy financing will be called for in the next few years. With the taking over of the street railway, the huge expenditures that must be made in extension and rehabilitation and the heavy capital outlays involved in other projects proposed, the citizens of Toronto can look forward to a debt that will increase by leaps and bounds in the next few years to possibly \$150,000,000. Debt charges will be almost doubled with the inevitable increases in the tax rate."

In addition to the industries, the merchants of the city of Toronto are very much disturbed by the increase in assessment. On September 20, 1921, at a meeting of the Retail Merchants' Association, that Association demanded immediate revision of the assessments on Yonge Street, the principal business street of Toronto. It was found that on the east side of the street the old assessment had been

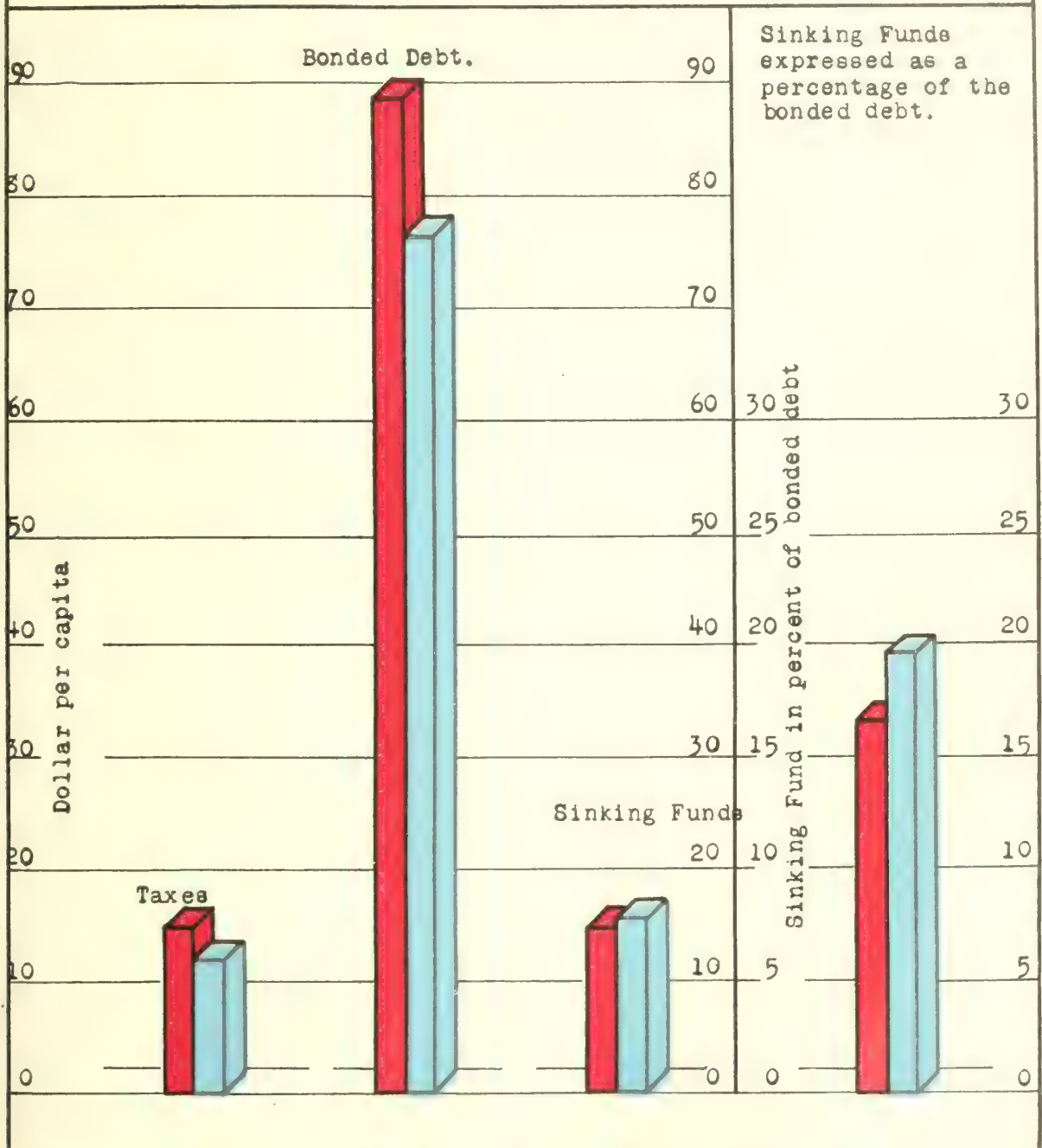
Figure 13

Taxes, Bonded Debt and Sinking Fund per capita
for all Municipalities of 25,000 or less
inhabitants in the Province of Ontario.

Legend

- Municipalities purchasing Hydro Service.
■ Municipalities not purchasing Hydro Service.

School Taxes and Bonds are excluded.



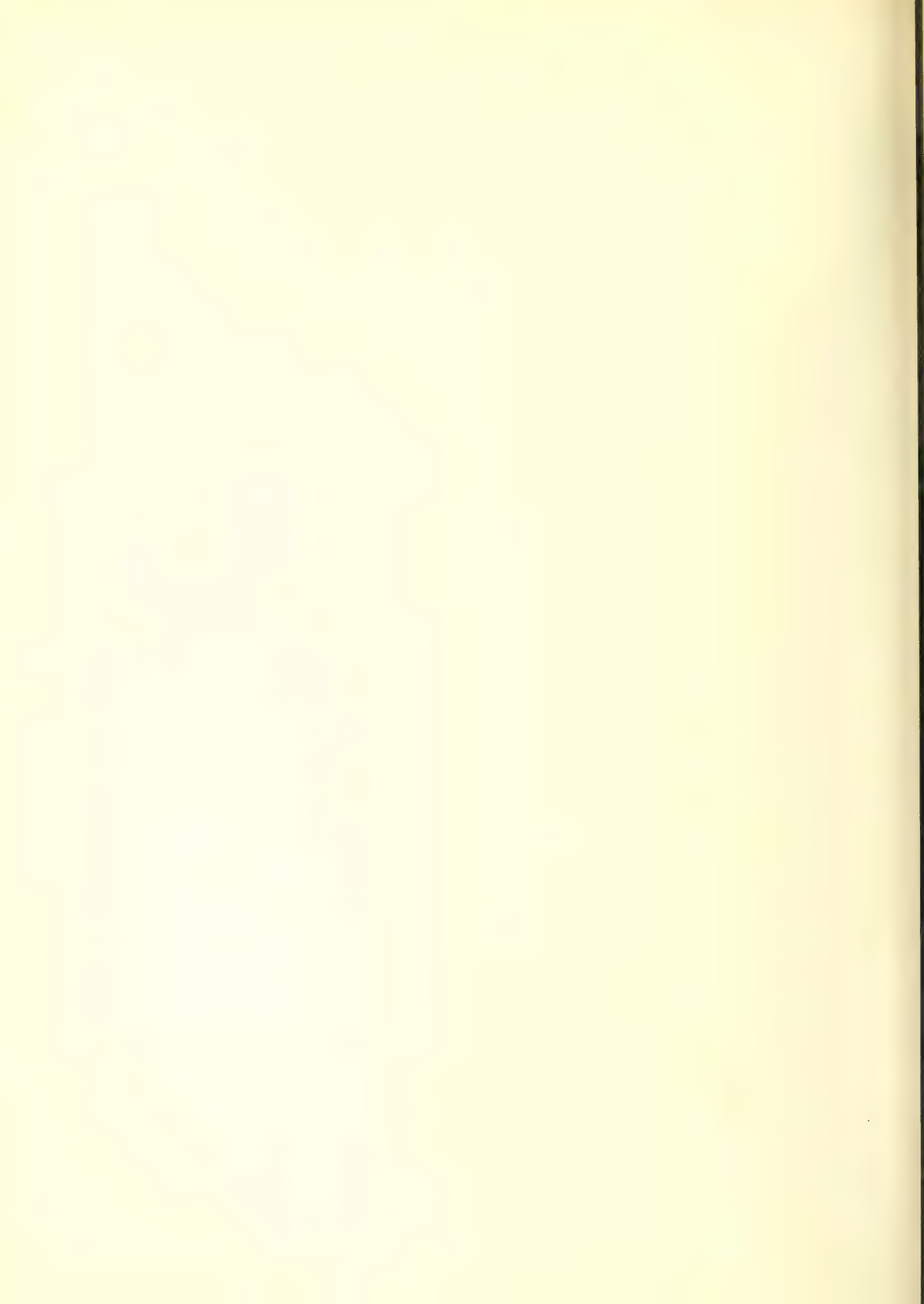


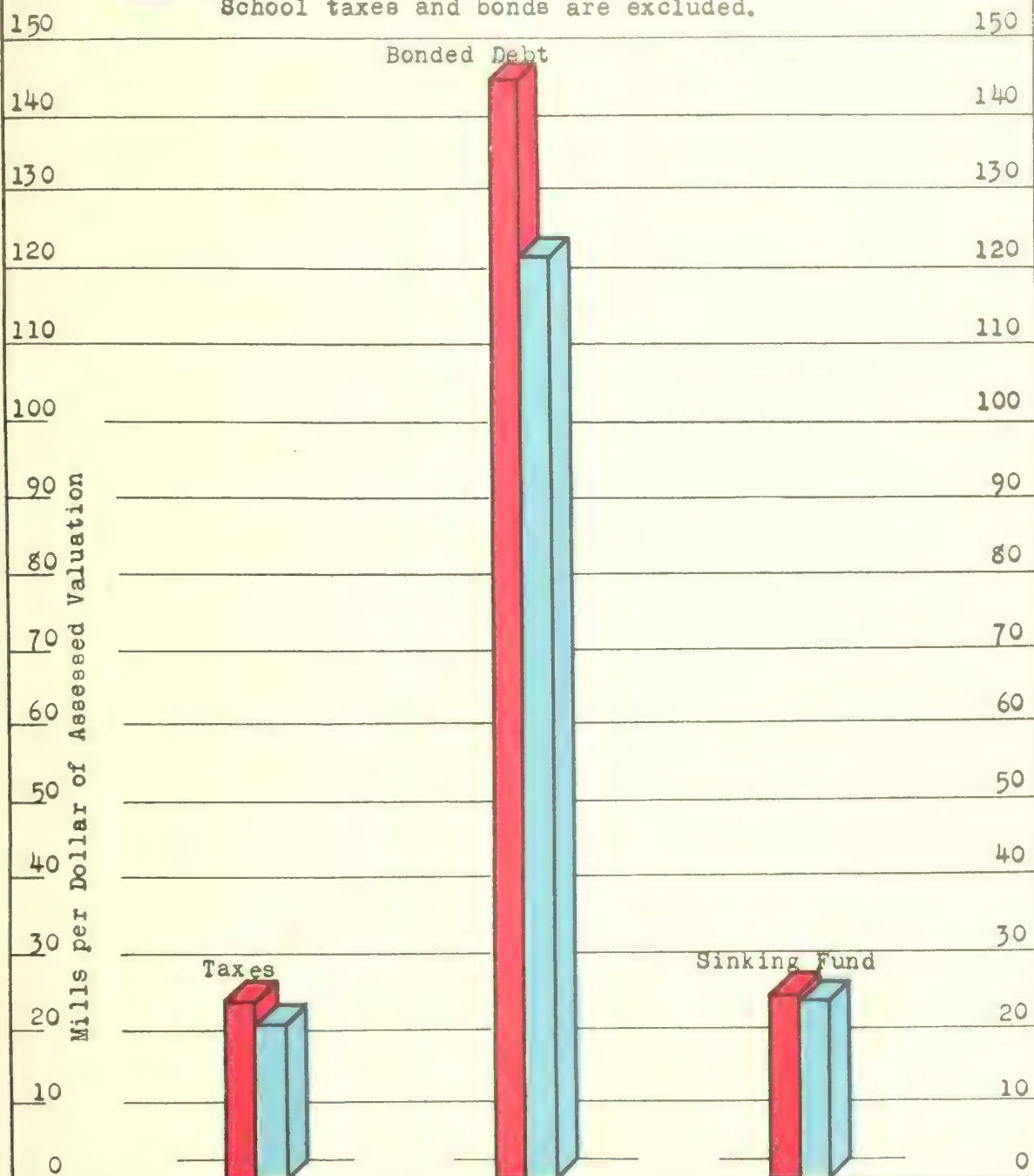


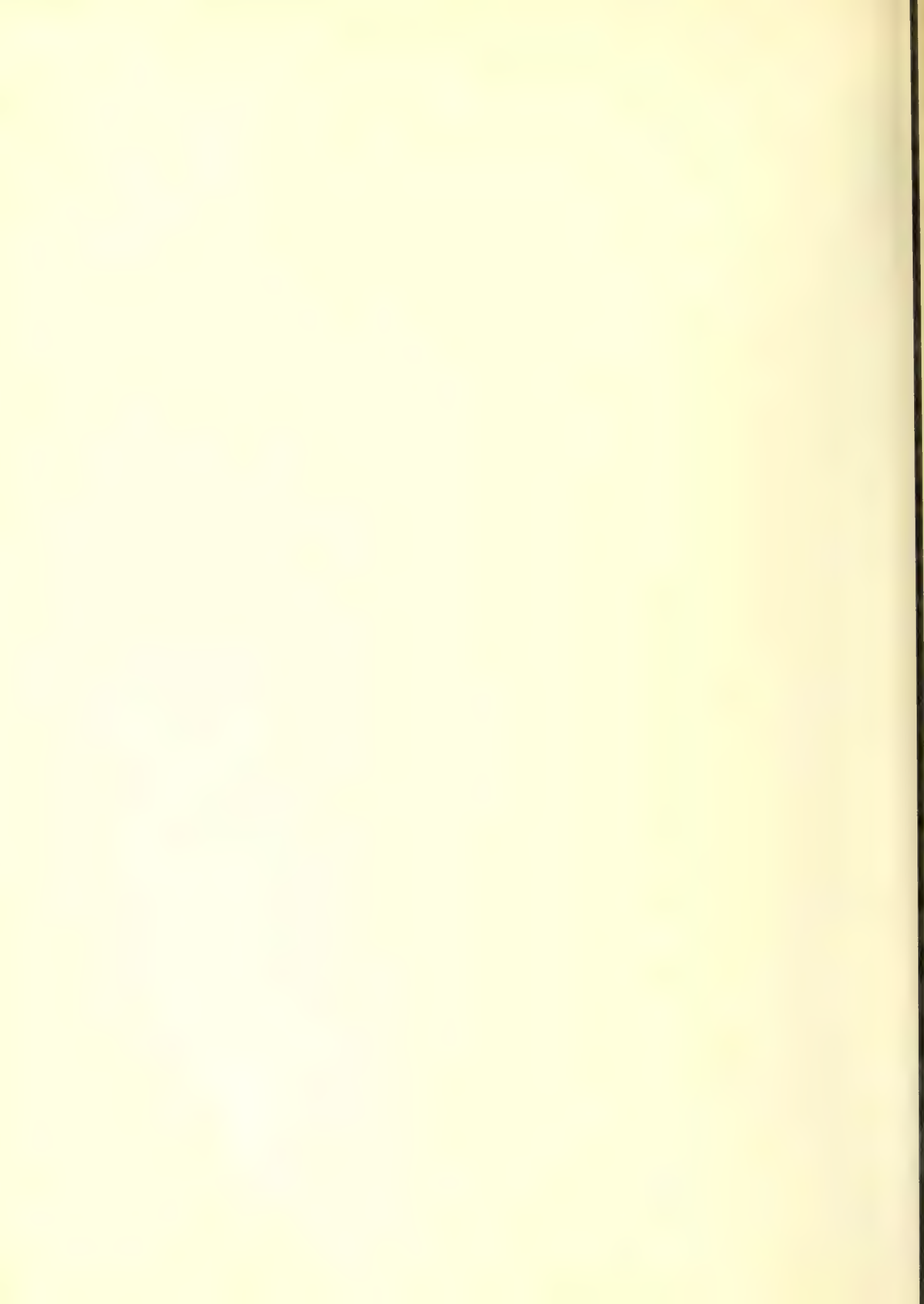
Figure 14

Taxes, Bonded Debt and Sinking Funds per Dollar of Assessed Valuation for all Municipalities of 25,000 or less inhabitants in the Province of Ontario.

Legend

-  Municipalities purchasing Hydro Service.
 Municipalities not purchasing Hydro Service.
 School taxes and bonds are excluded.





increased over 1920 by \$3,671,543 within the distance of a few blocks, and the Association stated that such an increase in assessment would drive some of the oldest business firms from their present quarters.

It would thus seem from the foregoing evidence that not only are the tax rates very high in Toronto, but that assessments are also taken on a very high plane, and this method of assessing property probably explains to a large extent the difference in assessed valuation per capita in the industrial cities of the Provinces of Quebec and Ontario.

A Comparison of the Municipal Statistics for Cities in the Province of Ontario Using Hydro Service to Those Not So Doing

The Bureau of Municipal Affairs, under the direction of the Provincial Secretary's Department of the Province of Ontario, prepares each year a publication entitled "Municipal Statistics," in which is given data concerning the assessed value, the taxation, the debenture debts and the sinking funds for each municipality, township or town in the Province. The last publication of this Bureau is dated February, 1921, and from this has been derived the information contained in Figures 13 and 14.

Every community in the Province of Ontario, within the limits of population given, whether a village, town or city, has been included in making up the figures here used, in order that no possibility may exist for the selection of certain groups which might not be representative of the true results over the entire Province.

The municipalities have been sub-divided into those using Hydro Service and those not so doing, and the taxes, net bonded debt and sinking funds for the totals of each of these groups have been determined on the basis of two units—first, per capita, and, second, in mills per dollar of the assessed valuation. In the comparisons, school taxes and bonds issued for school purposes have been excluded, as school expenses are kept separate from other municipal expenditures.

All municipalities in the Province of Ontario having a population greater than 25,000 are receiving Hydro service, making comparisons between cities of these larger populations impossible. For the cities of 25,000 or less the "Municipal Statistics" published by the provincial government show that as of 1920 there were 161 municipalities receiving Hydro Service and 139 not so doing, making a total of 300 municipalities within these latter population limits for which analyses were made.

Figure 13 shows the relation of taxes, bonded debt and sinking funds upon a per capita basis for the 300 municipalities of less than 25,000 inhabitants. Taxes and bonded debt of the municipalities purchasing Hydro Service were higher, while the retirement of the debt by sinking funds was not being carried out as rapidly by those cities using Hydro Service. This is illustrated by the respective sinking funds in terms of the present bonded debt; the rate of retirement being 13.8% less for the Hydro municipalities than for those not taking Hydro Service.

The taxes per capita for municipalities using Hydro Service were 12% greater than for those not taking Hydro, while the bonded debt per capita was 11.6% greater for cities using Hydro Service.

In Figure 14 is illustrated the relative taxes, bonded debts and sinking funds expressed in terms of mills per dollar of assessed valuation for the 300 municipalities having a population of less than 25,000. On this basis the taxes paid in municipalities purchasing Hydro Service are greater by 19.4% and the bonded debt is greater by 19.8% than in those municipalities not using Hydro Service. Sinking funds are about equal for each class of municipality.

The electric utility properties of the Hydro Electric Power Commission of Ontario and of the municipalities are exempt from taxes, except those levied against land, and, furthermore, by the Power Commission Act the municipalities are empowered to eliminate from the determination of the debt limit all investments in electric utilities made by them or by the Hydro-Electric Power Commission on their behalf.

The elimination of debentures issued for electric utility purposes from the determination of the debt limit removes an important check against the amount which municipalities may expend for this class of property, and the effect is particularly well illustrated in the smaller municipalities, whose liabilities as represented by government electric utility properties are several times the total of all other liabilities. Bolton, Ont., referred to on page 216, is an example of the effect of this legislation, as its municipal liability through government ownership of electric utilities has been increased by 428%.

In relieving the governmental electric utilities from paying taxes, except on land, such taxes are by no means eliminated. They are but transferred to another class of taxpayers, regardless of whether or not such taxpayers be customers of the governmental electric utilities. The magnitude of this relief is of importance, for the principal private electric utility companies in the Province of Ontario paid 7.10% of their revenues to the government for taxes in 1920.

The conclusion of the comparisons given in Figures 13 and 14, between 161 municipalities purchasing Hydro Service and 139 municipalities not so doing, is that taxes and bonded debts are lower for those municipalities which have refrained from governmental ownership of electric utilities, while, even with this lower taxation, these municipalities are retiring their bonded debt through sinking funds at a higher rate than are those municipalities using Hydro Service.

Taxes Received in 1920 from Electric Utilities in the Provinces of Ontario and Quebec and in the United States

Government electric utilities in the Province of Ontario, including both the operations of the Hydro-Electric Power Commission and of the Local Municipal Commissions, paid taxes in 1920 to the

amount of \$114,772. These taxes were equivalent to a rate of 1.5 mills for each dollar of investment in the property assessed, and they amounted to 0.99% of the revenue received from the revenue receiving service from the property. At the same rate, the taxes paid by the government electric utilities in Ontario in 1920 were only 0.08 mills. The figures showing the amounts of the taxes and the revenue received are given in the following tabulation:

	Investment	
Ontario Power Company.....	\$99,450	\$28,757,614
Hydro-Electric Power Commission.....	48	1,697,642
Thunder Bay System.....	20	84,999
Windsor System.....	.....	1,381,230
Wasdells System.....	.....	332,946
Muskoka System.....	.....	212,116
.....	.....	1,011
.....	.....	1,032,387
Bonnechere Storage.....	.....	34,165
Office and Service Buildings....	.....	1,197,288
.....	.....	194,187
Inventories.....	.....	221,712
Farm Equipment.....	.....	38,623
Municipal Distribution Systems..	5,475	26,172,894
Totals.....	\$114,772	\$77,057,432

The taxes paid by the Ontario Power Company are levied against the entire property and amount to approximately 3.5 mills per dollar of investment. This is by far the greater part of all taxes paid, and the Hydro-Electric Power Commission, through a recent decision of the Ontario Railroad Commission, has been released from the future payment of taxes against the property of the Ontario Power Company, except those which may be levied against land, under the terms of the Power Commission Act. Whether this decision will stand, if carried to higher courts by the Municipality of Niagara Falls, Ontario, is yet to be ascertained.

The taxes paid by the municipalities on their distribution systems are not readily ascertainable, and they have accordingly been estimated at \$5,475.00 by using the same tax rate against investment as that of the Toronto Hydro-Electric Power Commission, which paid \$2,385.00 against an investment of approximately \$11,137,000.00 in works.

The taxes paid by privately owned and regulated electric utilities, both in the United States and Canada, are an appreciable amount of their total revenues, and their costs per kw-hr. generated. These, for the principal private companies in the Province of Ontario, amount to 7.10% of their annual revenue, and to about 0.6 mills for each kw-hr. generated and purchased by these companies. For the privately owned electric utility companies in the St. Lawrence Valley of the Province of Quebec, the taxes received are 6.53% of the annual revenue, and about 0.46 mills per kw-hr. generated and purchased.

For the 35 light and power companies operating in the Niagara District of the United States, the taxes received for 1920 were 10.6% of the annual revenue and amounted to 0.9 mills per kw-hr. generated. In California the two principal companies paid 7.7% of their annual revenue and 1.07 mills per kw-hr. generated in the form of taxes.

Had the government electric utilities operating in the Province of Ontario been charged with taxes at the rates paid by private companies in Canada and in the United States, the Province and the municipalities would have received from these government electric utilities taxes in a sum total to the amounts shown in Figures 15 and 16, and the people in the Province of Ontario would have been relieved to this extent of paying taxes in other forms, because these taxes against the government electric utility properties would then become an element in the cost of power, and would be borne entirely by the customers taking that service.

Figure 15 shows the taxes that would have been paid by the government electric utilities of Ontario had these been charged with taxes proportioned to the revenue received from customers to the same extent as was paid in the same year by privately owned and regulated companies in the United States and Canada.

Figure 16 shows the taxes that would have been paid by the government electric utilities of Ontario had they been charged with taxes at the same cost per kw-hr.-generated as were the privately owned and regulated companies in the United States and Canada.

The taxes paid by the government electric utilities of Ontario for 1920 were approximately \$114,772, which amount is less by \$705,120 than the taxes which these government electric utilities would have been charged with at tax rates expressed as a percentage of the revenue which were charged against private electric utility companies operating in the Province of Ontario. Likewise, had the government electric utilities of Ontario in 1920 been charged with taxes at the same rate per kw-hr.-generated as were the private electric utility companies operating in Ontario, they would have paid, instead of \$114,772, approximately \$876,892, an amount greater by \$762,120.

While the relief from the payment of taxes permits the government electric utilities in Ontario to reduce their costs for power by a corresponding amount, this only results in a transfer of the costs from the power consumer to the taxpayer, whether or not the taxpayer is a power consumer.

Of the total taxes in Buffalo, the electric utility companies contribute \$1.03 per capita, while for the City of Montreal, the private electric utility companies contribute 74 cents per capita. In Toronto, however, the taxes paid by the private light and power companies and by the Local Commission, amount to approximately 21 cents per capita, of which the Local Hydro Service contributes only about one-half cent per capita.

For the populations served in 1920 the 35 light

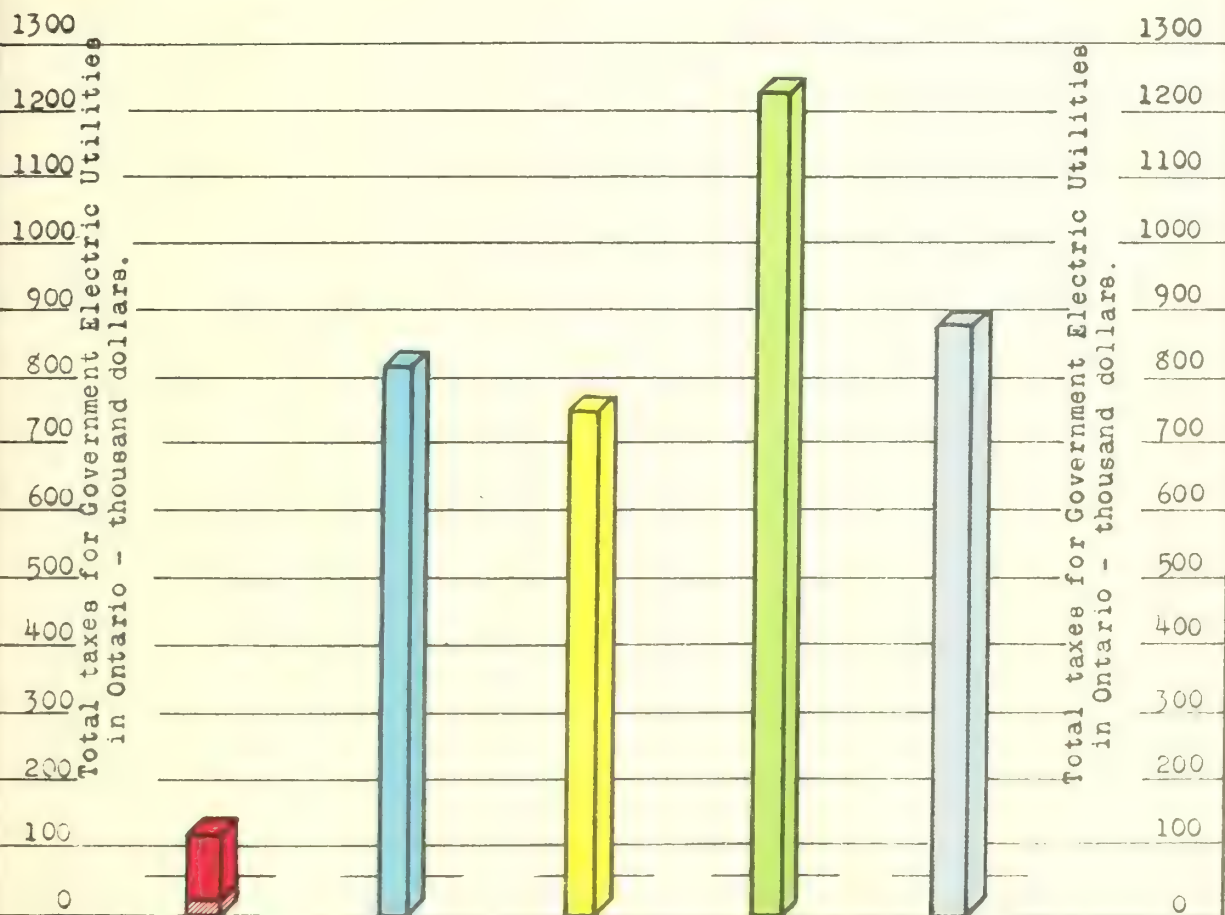
Figure 15

The taxes which would be paid by the Government
Electric Utilities of Ontario were their
operations charged with taxes at the
rates paid by private companies
in the United States and Canada.

Note: Based on the relation of taxes to revenue.

Legend.

- Taxes actually paid by government electric utilities in Ontario.
- Taxes paid by Ontario Power Company owned by Hydro.
- Taxes at the rate paid by Ontario private utility companies.
- Taxes at the rate paid by Quebec private utility companies.
- Taxes at the rate paid by American companies in Niagara District.
- Taxes at the rate paid by American companies in California.



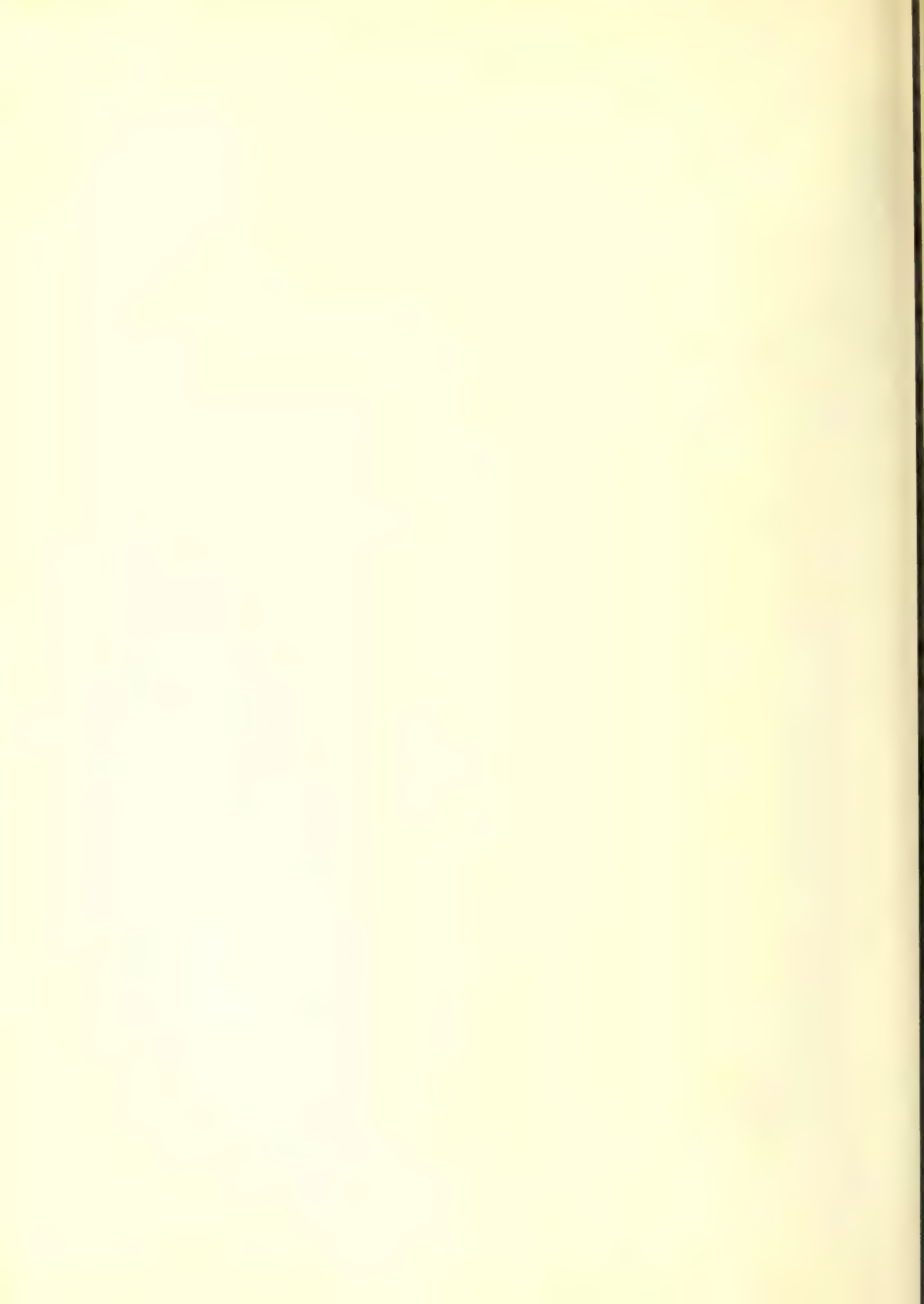






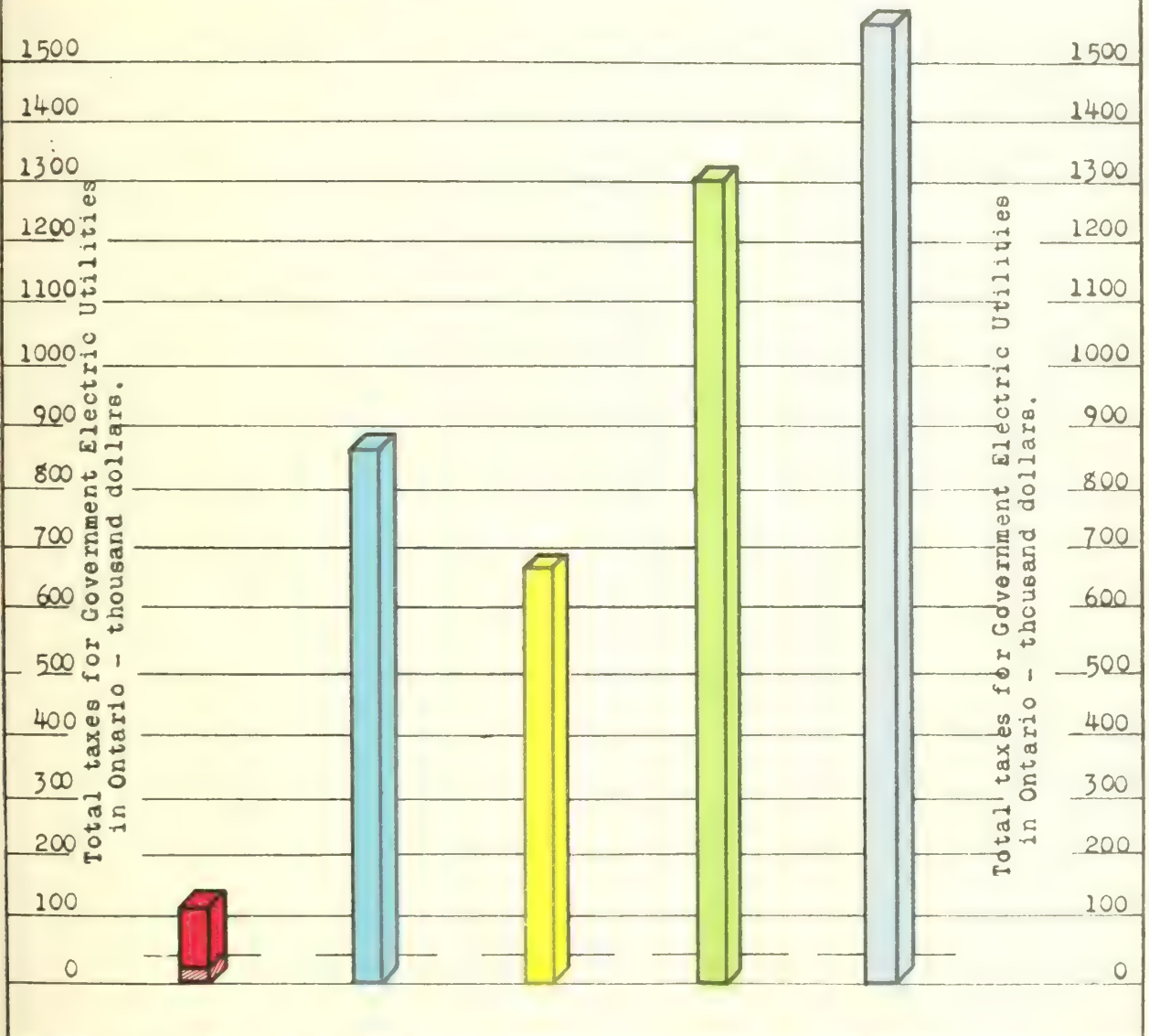


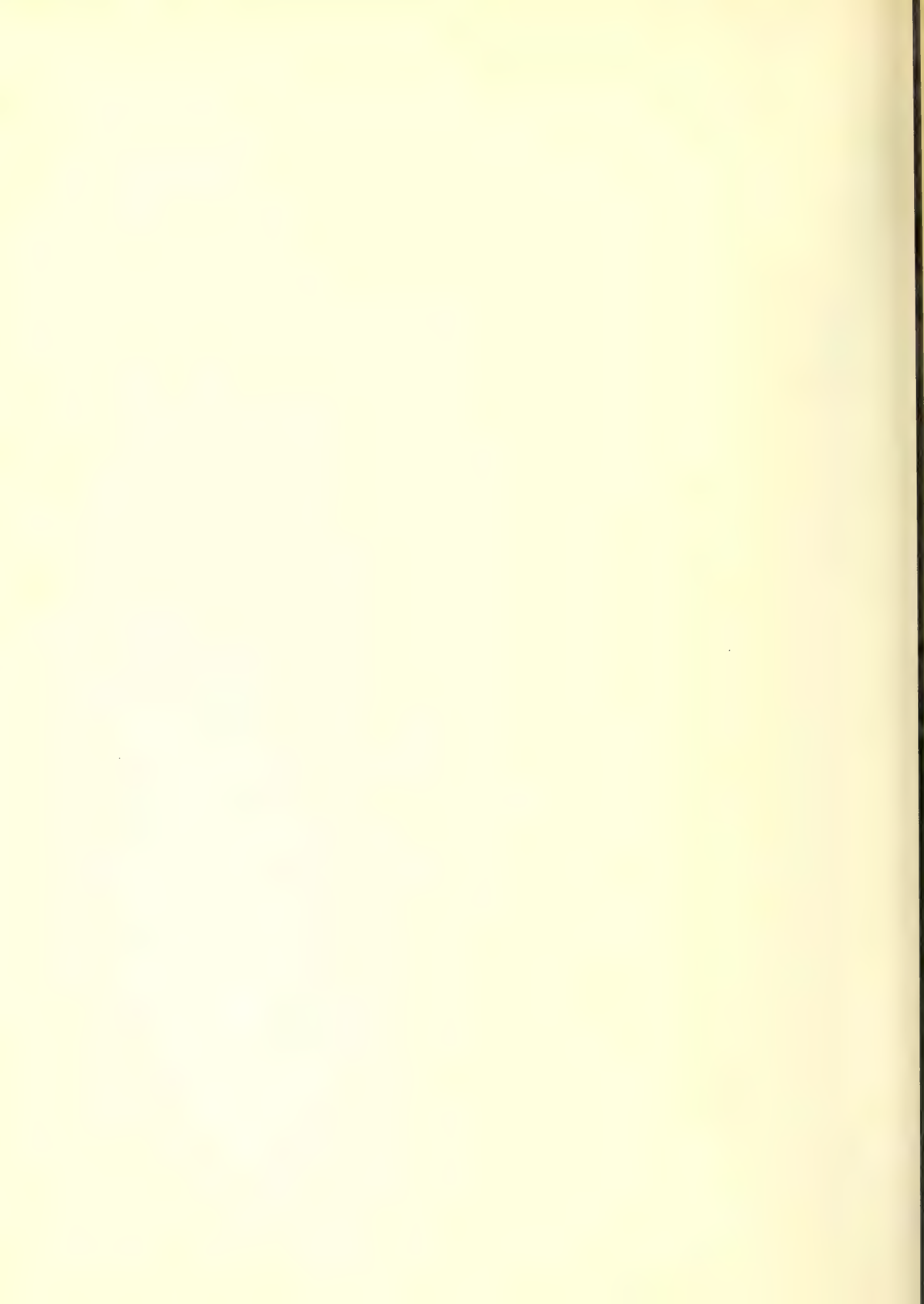
Figure 16

The taxes which would be paid by the Government
Electric Utilities of Ontario were their
operations charged with taxes at the
rates paid by private companies
in Canada and the United States.

Note: Based on the cost of taxes per kilowatt hour
Legend

-  Taxes actually paid by government electric utilities in Ontario.
-  Taxes paid by Ontario Power Company owned by Hydro.
-  Taxes at the rate paid by Ontario private utility companies.
-  Taxes at the rate paid by Quebec private utility companies.
-  Taxes at the rate paid by American companies in Niagara District.
-  Taxes at the rate paid by American companies in California.





and power companies in the Niagara Power District of the United States contribute for taxes \$1.44 per capita; in California, \$1.10 per capita.

The importance of the taxes borne by the private electric utility companies is well illustrated by these examples.

SECTION F—(PART II)

QUEENSTON - CHIPPAWA DEVELOPMENT FOR THE NIAGARA SYSTEM OF THE HYDRO-ELECTRIC POWER COM- MISSION OF ONTARIO

The Niagara System

The Niagara System is the most important of the several systems operated by the Hydro-Electric Power Commission. This system derives all of its power supply from power plants located at Niagara Falls, and the power sold from this system comprises 78% of the total supplied by the Hydro-Electric Power Commission. At the same time, 87% of the Commission's total output is produced by plants located at Niagara Falls.

The transmission lines of the Niagara System extend as far west as Windsor and as far east as Toronto. The maximum breadth of the Niagara district is approximately 75 miles, while the extreme length from Toronto to the vicinity of Amherstburg is approximately 360 miles. Within this district the longest transmission line distance is that to Windsor, about 235 miles.

The Niagara System was the first considered by the Ontario Power Commission, and, as is brought out in Section B, that Commission, which made its report in 1906, recommended the construction of a power plant at Niagara Falls to provide service for some 18 municipalities. By the construction of such a plant, the engineers of the Ontario Power Commission estimated they would be able to produce power at the switchboard of the plant for \$5.89 per horsepower year on the basis of a 60,000 horsepower development, and for \$4.95 per horsepower year upon the basis of a 100,000 horsepower development.

The Hydro-Electric Power Commission of Ontario, which succeeded the Ontario Power Commission, decided to purchase power from the Ontario Power Company, rather than construct a plant at Niagara Falls, as had been recommended by its predecessor, and accordingly made the contract of 1908 with the Ontario Power Company for the purchase of 100,000 horsepower, for which it was to pay \$9.40 per horsepower-year for the first 25,000 horsepower and \$9.00 per horsepower-year for the balance.

By 1915 the Niagara System had grown so that it was using the full 100,000 horsepower for which it had contracted with the Ontario Power Company, and it started negotiations for the purchase of that company. Meantime, however, it was necessary to obtain additional power, and the Hydro-Electric Power Commission contracted in 1916 with the Canadian Niagara Power Company for 50,000 horsepower at \$12.00 per horsepower-year at 12,000 volts.

In August, 1917, the purchase of the Ontario Power Company by the Hydro-Electric Power Commission was consummated. The plant of that company, at the time of the purchase, had an installed capacity of approximately 162,000 horsepower. Upon acquiring this property, the Commission decided to extend this plant to a capacity of approximately 202,000 horsepower, owing to the demands for war purposes, and, accordingly, it asked for a temporary permit from the Queen Victoria, Niagara Falls Park Commission to install a third pipe line and an additional 40,000 horsepower in machine capacity.

The Queenston-Chippawa project was first investigated by the Hydro-Electric Power Commission in 1913, when preliminary plans and surveys were made for the development of approximately 100,000 horsepower, utilizing the full head available from the Niagara River between Lake Erie and Lake Ontario.

The Inception of the Queenston-Chippawa Development

In September, 1915, the Hydro-Electric Power Commission made a report to the Province with respect to the development of 100,000 horsepower, and, as a result of this report, the Provisional Legislature passed the Niagara Development Act in 1916, which granted to the Commission the necessary authority to obtain money for the construction and to proceed with the development.

The Niagara Development Act was amended in 1917 so as to make the municipalities of the Niagara System, rather than the Province, the owners of the project. In the original licenses granted by the Queen Victoria, Niagara Falls Park Commission a provincial organization, to the three power companies operating on the Canadian side of the Niagara River, namely, the Canadian Niagara Power Company, the Ontario Power Company, and the Electrical Development Company, it was stated that the Government would not compete with these companies in the production of power at Niagara Falls, and the Niagara Development Act was amended to overcome this breach of contract by the Provincial Government. The transfer of the ownership of this development from the Province to the municipalities was assumed to eliminate the objections raised in respect to the breach of faith on the part of the Province.

The Niagara Power Development Act further affected the municipalities of the Niagara System in another respect. The original contracts between the Hydro-Electric Power Commission of Ontario and the several municipalities of the Niagara System stated in Schedule C, attached thereto, that the maximum price for power delivered to the municipi-

palties would not exceed certain specified amounts per horsepower-year-purchased, under the conditions set forth in the contract, but when the Niagara Power Development Act was passed this guarantee in respect to the maximum price for power to the municipalities was removed and each municipality was made liable for its proportion of the investments and the operating costs.

In January, 1917, bids were advertised for the construction of the Queenston-Chippawa Development, but, while several were received, none was accepted, and the Hydro-Electric Power Commission was authorized to proceed with the work on force account. In connection with the rejection of the bids of contractors, Mr. Gaby states:

"In January, 1917, tenders for construction work were called for and four or five large contracting firms on the Welland Canal, in Halifax, and in the Montreal District submitted tenders on the 'Cost Plus Basis' plus rental charge for ordinary steam driven plant.

"At the same time the Commission's Engineers submitted plans and estimates for an entirely new designed electrical driven equipment, which would eliminate the use of over 1,000,000 tons of coal, and require about one-third the number of men for its operation, and also greatly reduce the time for the completion of the work."

Preliminary work and engineering on the canal between the Chippawa River and the Queenston plant was commenced in May, 1917, while the actual excavation of the canal was started in March, 1918. The first unit of the development was placed in operation on December 28th, 1921.

Description of Queenston-Chippawa Development

This development, planned and being constructed by the Hydro-Electric Power Commission of Ontario, is the first on the Niagara River to utilize the full head available between the Chippawa Pool above the Falls and the waters at about the level of Lake Ontario.

The drainage area tributary to the intake of the development is 254,700 square miles, of which 151,500 square miles lies on the American side of the international boundary line. The diversion is taken from the mouth of the Welland River at an elevation of approximately 562.5 feet above sea level, while the tail waters are discharged at an elevation of 245.5, an average difference in elevation of 317 feet. The average effective net head at full capacity is estimated to be 305 feet.

The power plant will be located about one mile above Queenston. The water is brought to the power-house by means of the Welland River for about four miles and by a canal 8.75 miles long between the river and the forebay located above the power house.

The intake for the development is at the mouth of the Welland River. The ice problem being a very serious one on the Niagara River, the Commission's engineers have provided an elaborate plan

for obtaining the necessary protection against ice. This consists of the use of six concrete tubes, each about 600 feet long, laid in trenches in the river bottom, about 100 feet apart and pointing diagonally upstream. The tubes are tapered, increasing in diameter as they approach the shore, and for a distance of about 500 feet from the outer ends, they have an opening near the top on the upstream side through which the water will be admitted. The shore end of each tube passes through a concrete pier and discharges into a triangular-shaped forebay. The piers in which the tubes terminate are set in a row pointing diagonally downstream and are joined together by a concrete wall, which, together with the river bank and an island, enclose the forebay. The wall between each pair of piers is pierced with submerged openings for the entrance of water. Both these openings and the discharge ends of the tubes are provided with gates to regulate the flow. It is proposed to use the tubes during the ice season only.

At present, the site of the intake works is surrounded by a coffer dam and is pumped dry, but work on it is temporarily suspended.

The canal between the Niagara River and the entrance to the forebay is 66,287 feet in length, through which distance there are four typical sections. The first section, 21,000 feet long, follows the natural course of the Welland River, which is being dredged to a depth of 30 feet below mean water level and is to have a bottom width of 150 feet, with side slopes of 2 to 1. The second section is entirely artificial and is 6,250 feet in length, excavated in earth, with a bottom width of 70 feet. The sides will be covered with riprap laid on a slope of 1.5 to 1. The depth of water in the earth's section will be about 36 feet. The third section is in rock and is of a total length of 36,252 feet. This section is divided into two parts by the whirlpool section, which has a length, including transition, of 2,450 feet.

The sides of the rock section are lined with concrete to a height of about 33 feet, and the clear width between the concrete walls is 48 feet. It was originally intended to tie the concrete to the rock with $\frac{3}{4}$ -inch round rods, but this was later considered unnecessary and discontinued. The floor of the rock section is paved with concrete.

The whirlpool section is located where the canal crossed what was presumably the old course of the Niagara River. The width of the canal bottom is here 10 feet, with sides sloping 1.375 to 1. Both the bottom and sides are lined with concrete supported on rock fill. Transition sections join the whirlpool section with the adjoining rock sections. The canal changes direction five times, each bend having a radius of 300 feet.

Near the entrance of the rock section, there is to be placed an electrically-operated steel guard gate 48 feet wide by 42.5 feet high, which can be raised 14 feet clear above the water surface. This gate will be controlled from the generating station.

The canal widens at its lower end into a trian-

gular-shaped forebay about 1000 feet long by 500 feet wide, the depth of which is 36 feet in front of the screen house. The forebay is excavated in solid rock and the side walls, which are vertical, are plastered with concrete applied by a pneumatic gun.

In order to discharge any ice which may enter or form in the canal, there is provided at each end of the screen house a sluiceway closed by a steel gate. A concrete pipe 10 feet in diameter carries the discharge from each sluiceway to the river below, running parallel to the main penstocks. Supplementing the two sluiceways, and to serve for clearing ice from the forebay, located above the plant, a discharge tunnel is to be connected to the bottom of a hollow pier at the entrance of the forebay. This pier is triangular in plan, with its apex pointing upstream, and is constructed of concrete. It is planned to hang booms, or "skimmers," between this pier and the side walls of the canal in order to sweep the ice from the surface of the water entering the forebay.

The canal and forebay for the plant are so designed that surging of water following a sudden load change will not cause overflow.

Mr. Gaby states that the Commission's engineers conducted an intensive study to determine the losses in an intake and canal of the design adopted, using models of a 20-to-1 scale, and as a result of their experiments they estimate the maximum capacity of the intake and canal to be 20,000 cubic feet per second.

The screen-house superstructure is a steel-framed concrete building, 35 feet wide by 570 feet long, and contains an overhead traveling crane for handling the screens and stop logs. Besides the two ice sluiceways previously mentioned, there are ten main inlets for the penstocks to the main turbines and two inlets for penstocks for house turbines. Each main inlet is divided into three sections by piers and in each section there is a screen, upstream, from which slots for stop logs are provided.

The screen-house sits back 75 feet from the edge of the gorge, and the penstocks for about half of this distance consist of tunnels lined with concrete into which the lower end of the riveted penstocks are inserted. The upper two-thirds of each main penstock is 16 feet in diameter and the lower third is 14 feet, and the thickness of the steel plates increases in thirteen zones from $\frac{1}{2}$ inch at the top to $1\frac{1}{4}$ inch at the bottom. The distance from the inlet screens to the center line of the turbines following the center line of the penstocks is about 460 feet. No provision for expansion is made in the penstocks, as they are to be covered with 18 inches of concrete.

There is a Johnson valve at the lower end of each penstock between it and the turbine casing.

The generating station is planned for five vertical shaft units of 55,000 horsepower each. It is later proposed to install five additional units of 75,000 horsepower, making the ultimate plant capacity 650,000 horsepower. The present tur-

bines are designed to operate under 305 feet head at 187.5 revolutions per minute, and have a guaranteed efficiency of 88%.

Four vertical-shaft 2,500-horsepower service units operating at 500 revolutions per minute will supply energy for light and power purposes in the generating plant.

Each present turbine is directly connected to a 45,000-Kva., 12,000-V., 3-phase, 25-cycle generator. This generator is surmounted by an exciter driven directly from the main shaft. The generating room is approximately 60 feet wide by 60 feet high, with the units placed 50 feet center to center. About 100,000 cubic feet of air per minute is required to cool each generator at full load.

For the first installation comprising five generating units, there will be fifteen 15,000-Kva., 25-cycle, 12,000-volt to 110,000-volt, single-phase transformers, in which taps are provided to later permit operation at 132,000 volts.

The electrical equipment is laid out so that the station can be operated on the unit system; that is, the generator, bank of transformers, and transmission line will be considered as a unit and will have the same capacity, so that in case of emergency a unit may be operated to full capacity without utilizing either the high or low voltage buses. However, provision will be made so the units can be operated in parallel on either the high or low-voltage bus. Current-limiting reactors are provided between the generators on the 12,000-volt bus.

Allowing 1% for losses in inlets, penstocks and tailraces, and using the guaranteed efficiency of 88% for the turbines and 97.6 for the generators, gives a total efficiency between the forebay and the tailrace of 85%. With a 305-foot head between the forebay and the lower river, the output per cubic foot of water per second, at 85% efficiency, is approximately 29.5 horsepower at the low tension bus bars.

To generate 600,000 horsepower will then require 17,700 cubic feet of water per second, without allowance for service units and sluices. For these latter purposes, under ordinary conditions, 300 second feet would be a fair allowance, making the total required 18,000 cubic feet per second. In winter more sluicing water will have to be added at certain times to discharge the ice which may enter or form in the canal.

The velocity in the rock sections under the above conditions will be nearly 12 feet per second.

The designing and planning of the Queenston-Chippawa development, with the exception of the purely electrical portion, have been done by the Hydraulic Department of the Commission in Toronto; the electrical features by the Electrical Department. The actual work of construction has been done by the Commission itself, the latter having stated that no general contractor could be found to undertake the work under the uncertain conditions imposed by the war, and, further, that the construction equipment purchased by the Commission could be used in the future on the proposed development of the St. Lawrence River.

Engineering Reports in Respect to the Queenston-Chippawa Development

The Hydro-Electric Power Commission at different times employed several engineers to check various phases of the design and construction of the development. Among the engineers employed were Mr. R. D. Johnson, of Johnson & Wahlman, New York; Mr. Hugh L. Cooper, of New York, and Mr. Francis Lee Stuart, also of New York.

The several reports of these gentlemen have been read. The reports of Mr. Johnson have to do principally with the capacity of the canal, while those of Mr. Hugh L. Cooper are a study of the entire plan. The report made by Mr. Stuart has more to do with the type of construction plant used and the progress of the work that could be affected with this type of plant. However, Mr. Stuart did make estimates as to the cost for the development.

The Cooper Reports are three in number. The first is in the form of a letter to Sir Adam Beck from Mr. Cooper, dated July 6, 1920, in which Mr. Cooper states that if the program which the Commission has adopted is carried out, the first two units should be ready for commercial operation by October 1, 1921, and in which he also states in respect to the probable cost of works that he was in substantial agreement with the figures which the Commission had submitted to the Provincial Government.

The second is a report submitted with a letter of transmittal to Sir Adam Beck on August 7, 1920. In this report Mr. Cooper makes certain recommendations relating to changes in design, and he presented estimates for the cost of the works, if the plans adopted by the Commission are used, in the amount of \$66,423,418 for the first five units totaling 275,000 horsepower, and in the amount of \$76,636,931 for the ultimate installation of nine units, which was then proposed for an ultimate capacity of 495,000 horsepower. In this report Mr. Cooper, because of the lack of adequate water supply for Queenston under the existing International Treaty, also makes recommendations with regard to procuring additional diversion.

The final report of Mr. Cooper was submitted on October 22, 1920, and this is practically a review of the previous reports, with certain additional recommendations for the design.

The estimates prepared by Mr. Stuart in his report for the first installation of five units amounted to \$49,871,759, not deducting salvage, which he estimated at that time should amount to \$4,000,000 recoverable on construction plant and \$2,600,000 from the sale of crushed stone, making a total of \$6,600,000, thus giving a net estimated cost of \$43,271,759. For the ultimate installation of nine units, totaling 495,000 horsepower, Mr. Stuart estimated that the construction cost would be \$52,271,759.

Diversion of Water Available to the Queenston-Chippawa Development

- (1) The Original Contracts of the Power Companies on the Canadian Side of the Niagara River with the Queen Victoria, Niagara Falls Park Commission.

The Queen Victoria Niagara Falls Park Commission entered into agreements with the Canadian-Niagara Power Company in 1892, the Ontario-Niagara Power Company in 1900 and the Electrical Development Company, Limited, in 1903, permitting these companies to divert water from the Niagara River for the purpose of producing electrical or pneumatic power. The wording of each contract limits the amount of water diverted to the capacity of the works permitted, with the exception of the Electrical Development Company, Limited, which was specifically bound not to produce over 125,000 commercial horsepower under its agreement. In return for these licenses to produce electrical or pneumatic power, the three power companies agreed to pay certain fees based upon the amount of horsepower developed during each year.

In 1910 the International Treaty between Great Britain and the United States was signed, limiting the total diversion of water from the Niagara River for power purposes to 56,000 second feet, of which Canada was allotted 36,000 second feet and the United States 20,000 second feet.

The preliminary surveys for the Queenston-Chippawa Development were started during the summer of 1914, and authority for the construction of this development was obtained in 1916 through the Ontario-Niagara Development Act (6 Geo. V, Chapter 20). By an Order in Council, approved by the Lieutenant-Governor June 18, 1914, the diversion of water allowed to the three power companies operating on the Canadian side of the Niagara River was fixed as follows:

"In the case of the Canadian-Niagara Power Company, a volume of diversion from the Niagara River of the Falls of Niagara not to exceed 8,225 cubic feet of water per second."

"In the case of the Electrical Development Company, Limited, a volume of diversion not to exceed 9,985 cubic feet of water per second."

"In the case of the Ontario Power Company a volume of diversion not to exceed 11,180 cubic feet per second."

Providing the power company on the Canadian side took no water in addition to that allowed by the foregoing Order in Council, there would be left 6,610 second feet that could be used for the purposes of the Queenston-Chippawa Development.

Legal action was brought against the Province by the Electrical Development Company, Limited, as a result of this Order in Council, and to date these actions are still pending and the case undecided. The Electrical Development Company, Limited, however, did obtain relief through the decision of a Royal Commission, which, on April 25, 1918, allowed diversion to that company of 10,512 second feet, instead of the 9,985 second feet granted it under the Order in Council of 1914. The Royal Commission in its decision states:

".....our conclusion is that it may be taken that the Company is entitled to use 10,512 second feet of water.

"We find that the Company is not entitled at any time to develop more than 125,000 horsepower for commercial use....."

"We find that the capacity of the works installed or equipped by the Company is 150,000 horsepower for commercial use which exceeds by 25,000 horsepower the amount of horsepower which the Company is entitled to develop or generate for that purpose."

"Having regard to the circumstances and present conditions should the Company be ordered to deliver to the Hydro-Electric Power Commission of Ontario such excess power or energy, we are of the opinion and we find that a reasonable price for such excess power or energy is \$9.00 per horsepower per annum."

The Royal Commission obtained its authority by virtue of the Water Power Regulation Act passed in 1917, which Act permitted it to investigate the quantity of water that could be diverted, the amount of power which the Company was entitled to generate, the extent by which the capacity of the works exceeded that to which the company was entitled, and the price and terms upon which the excess power should be delivered to the Hydro-Electric Power Commission of Ontario.

Shortly after this decision by the Royal Commission, the Hydro-Electric Power Commission began to take the excess power over 125,000 commercial horsepower from the Electrical Development Company, Limited. The company, however, carried to the courts the question of the price to be paid and was later awarded a price higher than the \$9.00 per horsepower-year named by the Royal Commission.

The contract between the Canadian-Niagara Power Company and the Park Commission did not stipulate the capacity which the company would be allowed to install in its plant. In 1919 the company made provisions to add another generating unit, but before the Park Commission would grant permission for it to install this unit the company had to go on record that its works would not have a capacity in excess of 100,000 horsepower. This was the result of a discussion between the Park Commission and the Canadian-Niagara Company extending back to 1913. On November 5th of that year Mr. J. W. Langmuir, Chairman of the Park Commission, wrote Mr. A. Monroe Grier, Vice-President of the Canadian-Niagara Power Company, as follows:

"In view of certain matters..... relative to the use of Niagara River waters for power purposes, it has been found necessary to fix in the case of each of the power companies, namely, operating within the limits of the Park, a specific portion of the total volume which is available for diversion in Ontario under Article

'V' of the Boundaries Water Treaty between Great Britain and the United States."

"This matter has received careful consideration and in the case of your company it has been determined that, for the time being, a continuous uniform diversion of 7,940 cubic feet per second of diverted water shall be deemed sufficient for the efficient and proper development of 100,000 electrical horsepower by your company."

The Canadian-Niagara Power Company, up to 1919, did not assent to the above ruling made by the Park Commission. However, in 1919, in asking for permission to install unit No. 11, Mr. John H. Jackson, Superintendent of the Park, in answer to a letter from Mr. A. Monroe Grier, President of the Canadian-Niagara Power Company, on July 2, 1919, stated, in part, as follows:

"In reply to your letter of June 3rd last, it is to be inferred that this unit No. 11 is simply an insurance against any breakdown that may happen to any of the other units....."

"You are aware of the position taken by the Commission that the Canadian-Niagara Power Company has not the right to develop at any one time in excess of 100,000 horsepower....."

"Before the Commission's approval of the installation..... for this unit No. 11, they will require from you a distinct understanding in writing that such approval shall under no circumstances be used as the foundation of any claim on your part that you are entitled to develop in excess of the above mentioned limit....."

On July 25th Mr. Grier replied to Mr. Jackson as follows:

"Dear Sir: Replying to your letter of July 2nd, the proposed installation, the purpose of which is correctly inferred in your letter is absolutely without prejudice to our respective positions as to the company's right to developand we hereby give the distinct understanding in writing required by the Commission, namely, that the approval of unit No. 11 is under no circumstances to be used as a foundation of any claim on our part that we are entitled to develop in excess of the limit set forth in your letter of July 2, 1919."

By this agreement the Canadian-Niagara Company became limited as to its horsepower output, in addition to the previous limits imposed by the Order in Council as to the amount of water that could be diverted.

During the war there was a power shortage in the Niagara district, and, prior to its purchase by the Hydro-Electric Power Commission, the Ontario Power Company made plans to construct a third pipe line so as to be able to produce additional power.

However, this company was purchased by the Commission on August 1, 1917, and the Park Commission gave to the Hydro-Electric Power Commission a permit which allowed it to install the third conduit. This permission was granted with the understanding that the construction should be vacated in five years or by March 1, 1923, but since that date an agreement has been reached between the Park Commission and the Hydro-Electric Power Commission through which it will be possible for the third pipe line to be maintained in existence for an indefinite period of time. By the addition of the third pipe line the capacity of the Ontario Power Company's plant was increased from approximately 160,000 horsepower to 200,000 horsepower, and the diversion was increased by an amount in excess of that allowed by the Order in Council of 1914.

- (2) Investigations by the United States Government in respect to Water Diversion from the Niagara River.

Under Public Resolution No. 8 of the Sixty-fifth Congress of the United States, the Secretary of War was directed to make a comprehensive investigation of the diversion of water from the Great Lakes and the Niagara River. The report resulting from this investigation was completed and transmitted to the Secretary of War on November 9, 1920, by Major General Lansing H. Beach, the Chief Engineer of the United States Army, and contains the reports of Brigadier General H. Taylor, Senior Member of the Board, and of Colonel J. G. Warren, Division Engineer, Lakes Division.

It has been generally understood that the larger diversion of water allowed to Canada from the Niagara River; that is, 36,000 second feet compared to the 20,000 second feet allowed to the United States, was because of the diversion taken by the United States for the Chicago Drainage Canal. Colonel Warren states that the diversion of water to the Chicago Drainage Canal for 1917 amounted to an average of 8,800 second feet, and he recommends:

"that the Sanitary District of Chicago be authorized to divert not exceeding 10,000 cubic feet per second."

Colonel Warren states that the Welland Canal in Canada is diverting about 4,500 cubic feet per second, of which about 3,300 cubic feet per second is used for power purposes. The Welland Canal is the only navigable waterway between Lake Erie and Lake Ontario, and it serves a traffic of between 4,000,000 and 5,000,000 tons annually, of which about 10% of the operation pertains to the United States. In the United States the Black Rock Canal diverts about 700 cubic feet per second, and the Barge Canal 1,000 cubic feet per second.

The diversion of water from the Great Lakes before reaching the power companies at Niagara Falls is as follows:

	Diversion by Canada Cubic Feet per Second	Diversion by United States Cubic Feet per Second
Chicago Drainage Canal.....	.....	8,800
Welland Canal.....	4,500	....
Black Rock Canal.....	....	700
New York State Barge Canal .....	....	1,000
Total.....	4,500	10,500

The diversions from the Great Lakes basin before reaching Niagara Falls are therefore 6,000 second feet greater from the American side than from the Canadian, instead of 16,000 second-feet.

Colonel Warren has prepared a table showing the water diversion from the Niagara River at Niagara Falls in 1917. This table is shown in Paragraph 33 of his report, and to it has been added a second column, giving the diversion in 1920 from statements contained in Paragraph 34 of the same report.

WATER DIVERSION FROM NIAGARA RIVER AT NIAGARA FALLS IN CUBIC FEET PER SECOND

	1917	1920
United States		
Niagara Falls Co.:		
Niagara Plant	9,450	
Hydraulic Plant	7,840	19,500
Pettibone Cataract Paper Co.....	270	270
Total.....	17,560	19,770
Canada		
Ontario Power Company.....	13,300	13,300
Electrical Development Co., Ltd.	12,400	12,400
Canadian Niagara Power Co...	9,600	9,600
International Railway Co.....	125	125
Total	35,425	35,425

SURPLUS DIVERSION AVAILABLE BY INTERNATIONAL TREATY OF 1909.

United States.....	2,440	230
Canada	2,675	575

General Taylor, in Paragraph 36 of his report, states the gross heads and outputs per second foot at the several plants to be:

	Power Output	Gross Head	Horsepower per Sec. Ft.
Canadian Niagara Power Company	100,000	173	10.4
Ontario Power Co. (Hydro)	163,000	215	14.6
Electric Development Company	125,000	183	10.1
Queenston-Chippawa Development	294,000	313	29.4
Niagara Falls Power Company	100,000	219	10.6
Hydraulic Power Company	145,000	219	18.5

The Queenston-Chippawa project calls for an ultimate capacity of 650,000 horsepower with the present canal. The immediate development is being made for 275,000 horsepower in five units. General Taylor estimates that 29.4 horsepower can be developed for each cubic foot per second of water diversion on

this project, but in arriving at the amount of water required we have used the figure of 30 horsepower per cubic feet per second as a compromise between General Taylor's figures and those of Mr. Gaby, Chief Engineer of the Hydro-Electric Power Commission, who states he expects to do somewhat better than 30 horsepower per second foot.

On the basis of 30 horsepower per second foot, the amount of water diversion required for the Queenston-Chippawa Development will be as follows:

<i>Horsepower</i>	<i>Diversion in Cubic Feet per Second</i>
275,000.....	9,167
540,000.....	18,000
600,000.....	20,000

By the International Treaty of 1910, the Canadian Government was allowed a total diversion of 36,000 second feet. Deducting from this the amounts of water diversion allowed to the three power companies by the Order in Council in 1914, subsequently amended by the decision of the Royal Commission in 1918, 6,083 second feet is left available, not including the additional amount of water which is being taken by the Ontario Power Company since the addition of the third pipe line. This latter water diversion amounts to about 2,100 second feet, based on General Taylor's figures, which would leave a net balance of 3,983 second feet, provided the power companies on the Canadian side keep within the amounts of water allowed them by the above Order in Council.

If the amount of diversion required by Queenston is deducted from the apparent surplus between the water allowed by the International Treaty and the diversion allowed by the Order in Council of 1914 and its subsequent amendments, the following deficits in water diversion will exist for the Queenston-Chippawa Development:

<i>Horsepower Development</i>	<i>Deficit in Diversion Cubit Feet per Second</i>
275,000.....	5,184
540,000.....	14,017
600,000.....	16,017

The amounts of water at present being taken by the Canadian plants, as stated by Colonel Warren in his report, have been given previously. Using these figures as the basis of amount of water available for the Queenston-Chippawa Development, the following deficits in water diversion are found to exist:

<i>Horsepower for the Queenston-Chippawa Development</i>	<i>Deficit in Water Diversion in Cubic Feet per Second</i>
275,000.....	8,592
540,000.....	17,425
600,000.....	19,425

Federal, Provincial and the Hydro-Electric Power Commission officers were asked to discuss the sub-

ject of diversion from the Niagara River available to the Queenston-Chippawa project, but in every instance they have stated that they would prefer not to discuss this question because they expect a new International Treaty will soon be negotiated between Great Britain and the United States in respect to the further diversion of water from the Niagara River. On the other hand, the American Government, through the War Department, has made an exhaustive study of this situation, the results of which are set forth in General Taylor's report, and, assuming this to be correct as to fact, it is necessary to base all deductions upon the material contained in that report, as it is the only official statement available on this subject.

The three power companies on the Canadian side were never in agreement with the amounts of water allocated to them by the Order in Council of 1914, and these companies always protested that the total capacity permitted for development could not possibly be attained with the water diversion allowed them by this Order. This attitude on their part seems to confirm General Taylor's figures as to the amounts of water which these companies are actually taking, as he has used amounts in every instance somewhat larger than those stated in the Order in Council of 1914.

On April 15, 1918, Sir Adam Beck, appearing before the Committee on Water Power of the House of Representatives in Washington, stated:

"Ultimately you will generate your power and use the full head, as we intend doing on the Canadian side. If there is no sentiment to interfere with the use of the water at the Falls, it will be many years before you will be required to scrap these plants, but that sentiment may be renewed after the war, and there may be still a limitation imposed on its use. The 300,000 horsepower that we are installing at the present time will not require any more water than we are entitled to under the Treaty."

Later in the hearing, Sir Adam Beck stated:

"When we bought the Ontario Power Company, one of the objects in buying was we could scrap the plant in ten, fifteen or twenty years when water becomes still more valuable because of its scarcity, and because of curtailment in the use of it, and use this water more efficiently in connection with the scheme that we have in hand."

Speaking as to the additional diversion for war purposes for use on the American side, which was being discussed, Sir Adam also stated:

"Now we maintain that if you increase your allotment, which I think your Government will be quite prepared to agree to, because of the war conditions and necessary demands for water, we will also ask that our allotment be increased by 10,000 second feet."

The additional diversion then under discussion was not allowed, and to date the International Treaty of 1910 is still in force.

Assuming General Warren's figures as to the amount of water being taken by the Power Companies on the Canadian side to be correct, the deficiency in diversion which would result under the existing International Treaty would make necessary the closing down of the following capacity in other plants:

<i>Horsepower Capacity, Queenston-Chippawa with Water Diversion of International Treaty of 1910</i>	<i>Horsepower Capacity Which Must Be Closed Down to Provide Sufficient Diversion for Queenston</i>		
	Ontario Power Company	Electrical Development Company	Total
275,000	125,000	0	125,500
540,000	200,000	41,500	241,500
600,000	200,000	61,500	261,500

(3) A New International Treaty and Its Effect upon the Diversion to Canada.

General Taylor, in his report, states the following in paragraph 67:

"Recommended Treaty provisions: It is recommended that the treaty with Great Britain proclaimed May 13, 1910, be modified in the following particulars:

"That the treaty provide for the construction and maintenance of remedial works..... to be so designed and constructed that the scenic beauty of the Falls will be restored and preserved when 80,000 cubic feet of water per second is diverted from the Niagara above the Falls:

"That the limits of diversion from the Niagara River above the Falls, which the high contracting parties may permit within their respective jurisdiction, be raised from 20,000 cubic feet of water per second on the United States side to 40,000 cubic feet of water per second and from 36,000 cubic feet of water per second on the Canadian side to 40,000 cubic feet of water per second."

The feeling in Canada is that the existing International Treaty of 1910 will soon be redrawn to allow for greater diversion, and General Taylor, in his report of November 9, 1920, also recommends that the existing Treaty be modified. While it is not assured that such a treaty modification will be consummated, it is only fair in discussing the Queenston-Chippawa situation to assume that it will be successfully negotiated. As has been stated previously, the only official facts that could be obtained are those contained in General Taylor's report, and in the absence of any figures from official Canadian sources it is necessary that the additional diversion which would be available to the Queenston-Chippawa Development upon the conclusion of a treaty modification be based upon the recommendations made in General Taylor's report.

Assuming, therefore, that a new Treaty is negoti-

ated, and that both Canada and the United States be allowed a total diversion of 40,000 second feet, the Hydro-Electric Power Commission will have available 4,575 second feet after deducting the 35,425 second feet now being used by plants on the Canadian side other than Queenston.

With the amounts of water required by the Queenston-Chippawa Development previously given, the deficiency of water available for this development, providing the Treaty revision should be made in accordance with the recommendations of General Taylor, would be as follows:

<i>Horsepower Capacity for Queenston Plant</i>	<i>Deficiency of Water Cu. Ft. per Sec.</i>
275,000.....	4,592
540,000.....	13,425
600,000.....	15,425

For each of the capacities given, it will be necessary to partially close down the other plants at Niagara Falls owned by the Hydro-Electric Power Commission, as follows:

<i>Horsepower Capacity, Queenston-Chippawa with Total Water Diversion of 40,000 Cu. Ft. per Sec. to Each of Canada and the United States</i>	<i>Horsepower Capacity Which Must Be Shut Down to Provide Sufficient Diversion for Queenston</i>		
	Ontario Power Company	Electrical Development Company	Total
275,000	67,000	0	67,000
540,000	200,000	0	200,000
540,000	200,000	0	200,000
600,000	200,000	20,000	220,000

The Commission's original plan for the Queenston-Chippawa Development called for the construction of 100,000 horsepower development, but from time to time this has been increased, going by steps to 300,000 horsepower, 495,000 horsepower and finally to 650,000 horsepower. It is probable that, from a standpoint of unit construction cost, and with the canal of the capacity that the Commission engineers feel it is capable of developing, these latter plans will result in the development having a lower unit cost than could have been possible with the smaller sized construction, but with the status of water diversion as it stands today, it is difficult to say where the water is to be found for the complete operation of this development without closing a considerable portion of the other power plants on the Niagara River owned and controlled by the Hydro-Electric Power Commission.

Estimated Construction Cost for the Queenston-Chippawa Development

As stated by Sir Adam Beck, in Section A, the original estimates for the Queenston-Chippawa Development were submitted to the government in September, 1915, and were based upon an installation of 100,000 horsepower in capacity, together with a canal capable of transmitting 6,500 cubic feet of water. The estimated cost of the development at

that time, for the capacity mentioned, was \$10,-500,000.

In 1916 plans were adopted by which the capacity of the canal was increased to 10,000 cubic feet per second and that of the power plant to 300,000 horsepower at a total estimated cost of \$20,761,135.

The plans were again modified in 1918, and the capacity of the canal increased to 15,000 cubic feet per second, since which date, by lining the canal with concrete, it is estimated by the engineers for the Commission that its capacity will be increased to 20,000 cubic feet per second.

Sir Adam Beck states that the Commission has not estimated the cost of completing the ultimate development, but for the completion of the first five units totalling 275,000 horsepower, the Commission's costs will be approximately \$60,000,000, the exact figure depending upon the salvage received from the construction plant.

Mr. Gaby, in answer to question 36, in Section A, states:

"The commission receives the funds required in connection with the Queenston-Chippawa Development from the Provincial Government, and the sum so advanced to date is approximately \$56,000,000 including plant and materials in stock, of which a large proportion will be salvage."

This figure is given as the money expended for this development to the end of the fiscal year October 31, 1921.

Inasmuch as no engineering study was made of this project, and therefore, not being in a position to judge of the accuracy of any estimates, the annual costs for power produced by the Queenston-Chippawa Development have been based upon an investment of \$60,000,000 for the first 275,000 horsepower, as stated by Sir Adam Beck.

Estimated Annual Production Cost for Power to the Niagara System upon the Completion of the Queenston-Chippawa Development

When the Queenston-Chippawa Development goes into service, the Hydro-Electric Power Commission will have two power plants at Niagara Falls available for the delivery of power to the Niagara System, not including that of the Electrical Development Company, the ownership of which will be obtained by the Commission, upon the consummation of the "Clean-up-Deal." The output of this latter plant, however, will be almost entirely absorbed by its contracts with the Toronto Electric Light Company, the Toronto Street Railway Company and its other power users. The demands for power of the Niagara System, as it is at present constituted, must, therefore, be met by the Ontario Power Company and the Queenston-Chippawa Development.

For the Commission's fiscal year of 1920, the average production cost for power purchased by the municipalities, as measured at the delivery points, was approximately \$10.40 per horsepower year, to

which there was added an annual cost for the transmission system of \$9.40 per horsepower-year, making the total cost of power purchased by the municipalities and the companies served by the Niagara System \$19.80 per horsepower-year.

The original estimated cost made in 1915 for the Chippawa Development installation of 100,000 horsepower was \$10,500,000, or \$105.00 per horsepower of capacity. Taking into account the diversity existing between the power purchased by the municipalities and the corresponding plant capacity, the average cost for power purchased by them would have amounted to about \$9.00 per horsepower-year and it was on this basis that the Niagara Power Development Act was passed by the Provincial Legislature, giving authority to the Hydro-Electric Power Commission to proceed with the construction of the Queenston-Chippawa Development.

The construction in progress on the Queenston-Chippawa project, at the present time, calls for the installation of 275,000 horsepower, while the ultimate development, as stated by Mr. Gaby in Section A, calls for the installation of 650,000 horsepower.

In estimating the annual production cost for power for the Niagara System, the provisions of the Power Commission Act must be kept in mind. This Act permits the Commission to contract with companies for the sale of power; the profits from which contracts are credited or debited against the cost of power to the System. In the following estimates the contracts made by the Ontario Power Company with the Niagara, Lockport and Ontario Power Company, and also with industrial consumers in Canada, have been treated as required by the law, in other words, both the revenues obtained from these contracts and the power sold have been credited against the operating cost, leaving a balance representing the cost that must be paid by, and the power that will be available to, the Niagara System.

The estimates following are constructed to show costs using the same elements as are employed by the Hydro-Electric Power Commission. Sinking funds have been included but all taxes have been excluded.

(1) Estimated Annual Production Cost for Power Delivered to the Niagara System, from the Ontario Power Company and from a 275,000 Horsepower Installation on the Queenston-Chippawa Development with Diversion of Water as Limited by the Existing International Treaty between Great Britain and the United States:

The estimated cost for the construction of the Queenston-Chippawa Development to a capacity of 275,000 horsepower, as stated by Sir Adam Beck is	\$60,000,000
The fixed assets of the Ontario Power Company, as of October 31, 1920, were	28,757,614
The total investment for these two power developments then is	\$88,757,614

The generator capacity installed in these two developments in electrical horsepower will be 477,000 hp.

Based upon the report to the War Department of the United States, of General H. Taylor, of the Board of Engineers for Rivers and Harbors on August 24, 1920, there is, under the existing International Treaty, in respect to the diversion of water for power purposes at Niagara Falls, insufficient water available to Canada for the operation of the full 275,000 horsepower to be installed in the Queenston plant, without closing down a portion of the capacity installed in other power plants on the Canadian side of the Niagara River, and using the amounts of water as stated by General Taylor now being diverted by Canadian plants, it will be necessary to close down the capacity in the Ontario Power Company to the extent of 125,500 hp.

This leaves an installed capacity available for meeting annual peak loads of 351,500 hp.

An adequate reserve machine capacity for these two power plants should be at least equal to the capacity of the largest generating unit contained therein, which is 55,000 hp.

Adding this reserve capacity to that available to meet peak loads gives a total machine effective plant capacity of 406,500 hp.

The difference between the total generator capacity installed in these plants and the effective capacity plus reserve represents that capacity in the Ontario Power Company which becomes obsolescent by the diversion of water to supply the Queenston-Chippawa Development, and this amounts to 70,500 hp.

The total investment per installed horsepower of effective plant capacity with reserve then is \$218.00

The investment per horsepower without reserve is \$252.00

The Ontario Power Company sells power to others than the Niagara System. One contract is that with the Niagara-Lockport & Ontario Power Company, which, by the terms of that contract, is entitled to take 60,000 hp.

The Ontario Power Company is further committed by other power contracts for approximately 48,000 hp.

The total commitments, therefore, of the Ontario Power Company, other than those to the Niagara System, are approximately 108,000 hp.

Deducting these commitments from the peak capacity of 351,500 horsepower leaves a peak capacity available to the Niagara System of 243,500 hp.

The annual production costs have been based upon the past records of operation, for the Ontario Power Company and of the American Company at Niagara Falls. The itemized annual production costs are estimated as follows:

Interest upon Investment

Queenston-Chippawa	\$3,450,000
Ontario Power Company	913,000

Administration Maintenance and Operation

Queenston-Chippawa	344,000
Ontario Power Company	303,000

<i>Water Power Rentals</i>	200,000
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<i>Insurance</i>	30,000
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Renewal Reserves

Queenston-Chippawa	750,000
Ontario Power Company	1,264,000

Sinking Fund

Queenston-Chippawa	1,068,000
Ontario Power Company	512,000

Total Estimated Annual Production Cost

\$8,834,000

Through its contract with the Niagara, Lockport & Ontario Power Company, the Ontario Power Company receives an annual revenue estimated to be \$593,000

And in addition the Ontario Power Company receives revenues from its contracts, other than with the Niagara System and with the above company, of approximately \$685,000

Making the total revenue received by the Ontario Power Company from contracts other than with the Niagara System approximately \$1,278,000

Which, when deducted from the estimated annual production cost of \$8,834,000, leaves as the cost for power produced for the Niagara System \$7,556,000

Therefore, the cost for power production per horsepower-year of machine capacity, without reserve, to the Niagara System, at the busses of the generating plants and the Niagara Station is \$31.10

Mr. Stanley Richardson, of the Operating Department of the Hydro-Electric Power Commission states that the diversity existing between the power purchased by the municipalities and the corresponding peak impressed upon the generating plants has been approximately 20% during the periods of

power shortage, and that this diversity should be reduced to about 10% when ample generating capacity is available. To be conservative, a diversity of 15% is taken, which, when applied to the estimated annual production cost at the busses of the power plant, reduces the annual production cost per horsepower-year purchased by the municipalities and companies on the Niagara System, when measured at the delivery points to

To the estimated annual production cost, there must be added the cost per horsepower-year for transmission, which, for the Niagara System, during the fiscal year of 1920, was..... \$28.05

The total wholesale cost for power per horsepower-year purchased by the municipalities and companies of the Niagara System, when taking power to the extent and under the conditions enumerated above, will then be..... \$9.40

In the preceding estimate for the annual production cost, interest upon the Queenston-Chippawa investment is taken at a rate lower than that paid by the Commission to the Province for the use of money for this development. The reason for this is that it is the Commission's practice, when placing property in operation, to charge against it the average interest rate for all operating property, and when the Chippawa Development is placed in operation, it is estimated that the average interest rate on operating property of the Commission will be approximately 5.75%. The interest against the transmission lines should also be increased from 4.55%, which was the average interest on operating property for 1920, to 5.75%, but, in view of the fact that labor and material costs should be lower than they were for 1920, this was not done. The interest rate used for the Ontario Power Company is somewhat less than that for the fiscal year of 1920, due to the probability of lower rates for American exchange.

The estimated cost for administration, maintenance and operation for the Ontario Power Company is reduced from that of 1920 in view of decreasing labor and material costs.

The renewal fund for the Ontario Power Company is based upon the rate of \$390,000 for the complete investment, which Mr. Clarkson stated in an interview, on November 16, was felt by the Commission's engineers to be adequate. That portion of the plant of the Ontario Power Company made obsolescent through diverting water to the Queenston-Chippawa Development is about 35% of the total capacity. The obsolescent capacity must be amortized over a relatively short period and a 9% amortization rate has been used for this portion of the investment, while for the balance of the capacity, the same rate for renewals has been taken as was used by the Commission's engineers.

The estimated cost for power delivered to the

municipalities and companies of the Niagara System of \$37.45 per horsepower-year is an increase of \$17.65 per horsepower-year, or 89% over the costs of \$19.80 per horsepower-year stated by the Commission in its 1920 annual report.

The increase in the production cost per horsepower-year from \$10.40 for 1920 to \$28.05 amounts to approximately 170%.

The above estimate covers only that period when Queenston is loaded to 275,000 horsepower and with the diversion permitted by the present International Treaty between Great Britain and the United States. The unit cost for power delivered to the municipalities and the companies of the Niagara System will, of necessity, be higher than those until such a time as this development is so loaded.

The total annual increase for the cost of power to the municipalities of the Niagara System resulting from the development of 275,000 horsepower at Queenston with the diversion allowed by the present International Treaty, will be approximately \$4,306,000 per annum.

(2) Estimated Annual Production Cost for Power Delivered to the Niagara System from the Ontario Power Company and from a 275,000 Horsepower Installation on the Queenston-Chippawa Development, with Diversion of Water as Recommended by General H. Taylor in his Report to the War Department of the United States:

General Taylor, in his report of August 24, 1920, recommended that the International Treaty be revised to permit a diversion of 80,000 cubic feet per second, 40,000 to Canada and 40,000 to the United States. If these recommendations were adopted, Canada would obtain 4,000 cubic feet per second in addition to the amount it now has authority to use under the present treaty.

The estimated investment cost would be the same as for the previous analysis, or \$88,757,614

The generator capacity installed in these two developments in electrical horsepower will be 477,000 hp.

Based upon the recommendation to the War Department of the United States by General H. Taylor, the 40,000 cubic feet per second for Canada will be insufficient for the operation of the full 275,000 horsepower to be installed in the Queenston plant without closing down a portion of the capacity installed in other power plants on the Canadian side of the Niagara River, and using the amounts of water stated by General Taylor is now being diverted by Canadian plants, it will be necessary to close down the capacity of the Ontario Power Company to the extent of 67,000 hp.

Which leaves an installed capacity available for meeting an annual peak of 410,000 hp.

Adequate reserve machine capacity for these two power plants should be at least equal to the capacity of the largest generating unit contained therein, which is 55,000 hp.

Adding this generator capacity to that available to meet peak loads, gives a total machine effective plant capacity of 465,000 hp.

The difference between the total generator capacity in these plants and the effective capacity plus reserve, represents that capacity in the Ontario Power Company which becomes obsolescent by the diversion of water to the Queenston-Chippawa Development Company. This amounts to 12,000 hp.

The total investment per installed horsepower of effective plant capacity with reserve then is \$191.00

The investment per horsepower without reserve capacity is \$216.00

The commitments of the Ontario Power Company other than to the Niagara System, as previously stated, are approximately 108,000 hp.

Deducting these commitments from the peak capacity of 410,000 horsepower, leaves a peak capacity available to the Niagara System of 302,000 hp.

Annual Production Costs:

The annual production costs are the same as those previously given, namely \$8,834,000, with the exception that the renewal reserve for the Ontario Power Company is reduced because of the smaller obsolescent capacity by \$500,000 which reduces the total estimated annual production expense to \$8,334,000

Through its contracts with companies other than the Niagara System, the estimated annual revenue to the Ontario Power Company is approximately.... \$1,278,000 which, when deducted from the estimated annual production cost of \$8,334,000, leaves as the cost for power produced for the use of municipalities and companies of the Niagara System \$7,056,000

Therefore, the average cost per horsepower-year of machine capacity without reserve to the Niagara System for power production at the busses of the generating plants and the Niagara Station is \$23.40

Applying the diversity of 15% used in the previous analysis reduces the cost of power per horsepower year purchased by the municipalities and companies of the Niagara System at the delivery points to..... \$20.40

To this must be added the cost per horsepower-year for transmission, which, for the Niagara System in the fiscal year of 1920, was \$9.40

The total wholesale cost for power per horsepower-year purchased by the municipalities and companies of the Niagara System, when taking power to the extent and under the conditions enumerated above, will then be \$29.80

The estimated cost per horsepower-year for power delivered to the municipalities and companies of the Niagara System of \$29.80 is an increase of \$10.00, or 51%, over the cost of \$19.80 per horsepower-year stated by the Commission in its 1920 annual report.

The increase in the production cost per horsepower year from \$10.40 for 1920 to \$20.40 amounts to 96%.

The total increase in the cost of power to the municipalities of the Niagara System resulting from the development of 275,000 horsepower at Queenston with the available diversion of water to Canada of 40,000 cubic feet per second, as recommended by General H. Taylor, will, when this development is fully loaded, amount to approximately \$3,020,000 per annum. The unit costs for power delivered to the municipalities prior to the time when the Queenston-Chippawa Development is loaded to 275,000 horsepower will, of course, be greater than those here stated.

(3) Estimated Annual Production Cost for Power Delivered to the Niagara System from the Ontario Power Company and from a 575,000 Horsepower Installation on the Queenston-Chippawa Development with a Diversion of Water, as recommended by General H. Taylor, in his Report to the War Department of the United States:

The estimated investment for Queenston-Chippawa, for the first 275,000 horsepower, as stated by Sir Adam Beck on December 14, 1921, is..... \$60,000,000

And for the next 300,000 horsepower, making a total plant capacity of 575,000 horsepower, it is..... \$9,000,000

The fixed assets of the Ontario Power Company as of October 31, 1920, are..... \$28,757,614

The total estimated investment, therefore, is \$97,757,614

The capacity available from these plants will be..... 777,000 hp.

Based upon the recommendation of 40,000 cubic feet per second diversion for Canada and 40,000 cubic feet per second for the United States by General H. Taylor, there is left, after deducting the amounts of water used by the Canadian Niagara Power Company

and the Electrical Development Company, about 18,000 cubic feet per second, from which there can be developed in the Queenston plant..... 540,000 hp.

Adequate reserve machine capacity for the Queenston plant should be at least the capacity of the largest generating unit in the Queenston station, or.. 75,000 hp.

Adding this reserve generator capacity to that available to meet the peak loads gives a total machine effective plant capacity of..... 615,000 hp.

Which will involve closing down the plant of the Ontario Power Company to the extent of..... 162,000 hp.

The investment per horsepower of effective capacity with reserve is..... \$159.00

And the investment per horsepower without reserve capacity is..... \$181.00

Based upon the records of the Ontario Power Company and the American Niagara Power Company, the estimated annual production costs are:

Interest on the Investment

Queenston-Chippawa \$5,620,000
Ontario Power Company..... 913,000

Administration, Maintenance and

Operation

Queenston-Chippawa 633,000
Ontario Power Company..... 40,000

Water Power Rentals..... 307,000

Insurance 45,000

Renewal Reserves

Queenston-Chippawa 864,000
Ontario Power Company 2,178,000

Sinking Fund

Queenston-Chippawa 1,228,000
Ontario Power Company..... 512,000

Total Annual Estimated Production Cost: \$12,310,000

From this amount there must be deducted the approximate sales of power to customers other than the Niagara System, which is..... \$1,278,000
leaving as the production cost for power to the Niagara System..... \$11,032,000

From the machine capacity without reserve there must be deducted 108,000 horsepower the approximate sales to customers of the Ontario Power Co. other than the Niagara System, which leaves available for peak loads on the Niagara System..... 432,000 hp.

Therefore, the average cost of power production per horsepower-year of machine capacity without reserve to the Niagara System at the busses of the generating plants and the Niagara Station, is..... \$25.60

Applying the diversity of 15% used

in the previous analyses reduces the cost per horsepower-year of power purchased by the municipalities and companies of the Niagara System at the delivery points to..... \$22.30

To which must be added the cost per horsepower-year for transmission for the Niagara System, in the fiscal year of 1920, of \$9.40

The total wholesale cost per horsepower-year for power purchased by the municipalities and companies of the Niagara System, when taking power to the extent and under the conditions enumerated will then be..... \$31.70

The estimated cost per horsepower-year for power delivered to the municipalities and companies of the Niagara System of \$31.70 is an increase of \$11.90 or 60% over the cost of \$19.80 stated by the Commission in its 1920 annual report.

The increase in the production cost per horsepower-year from \$10.40 for 1920 to \$22.30 amounts to 114%.

The total increase in the cost of power to the municipalities of the Niagara System resulting from the development of 575,000 horsepower at Queenston with 40,000 cubic feet per second available to Canada will, when this development is fully loaded, amount to approximately \$5,150,000 per annum.

The unit cost for power delivered to the municipalities prior to the time when the Queenston-Chippawa Development is loaded to this amount will be greater than this amount.

(4) Estimated Annual Production Cost for Power Delivered to the Niagara System from the Ontario Power Company and from 275,000 and 650,000 Horsepower Installations for the Queenston-Chippawa Development with an Unlimited Diversion of Water:

Mr. Gaby, in Section A, states that an ultimate development for 650,000 horsepower for the Queenston-Chippawa plant is now contemplated.

Under the present International Treaty or with the diversion recommended to the United States War Department by General Taylor, it would be impossible to develop this amount of power at Queenston without completely shutting down the Ontario Power Company, and also shutting down a portion of one of the other power plants on the Canadian side of the river.

The canal for the Queenston-Chippawa Development is estimated, by Mr. Gaby, to have a maximum capacity of 20,000 cubic feet per second, which would permit of the development of 600,000 horsepower for peak load at Queenston.

The following estimate is prepared, using the assumption that the water diversion at Niagara Falls is not limited, therefore making available sufficient water for the use of all of the plants installed:

MURRAY AND FLOOD REPORT

The estimated cost per horsepower-year for power delivered to the municipalities and companies of the Niagara System of \$27.90 for a 275,000 horsepower installation at Queenston with unlimited water supply, is greater by \$8.10, or 41%, than the cost stated by the Commission in its 1920 annual report.

The increase in the unit cost of power delivered to the municipalities with a 650,000-horsepower plant at Queenston, having unlimited water supply, is approximately 3%.

The increased cost in production over that for 1920, at the busses of the generating station for the 275,000-horsepower plant with unlimited water supply, amounts to approximately 78%, while that for the 650,000 horsepower plant is about 5.3%.

The total increase in the cost of power to the municipalities and the Niagara System, resulting from the development of 275,000 horsepower at Queenston with an unlimited water diversion available amounts to approximately \$2,450,000, while the increase in the cost to the municipalities through the

	<i>Machine Capacity for the Queenston Plant</i>	
	275,000 H.P.	650,000 H.P.
Estimated investment for the Queenston-Chippawa plant is.....	\$60,000,000	\$70,250,000
Fixed assets of the Ontario Power Co. are.....	28,757,614	28,757,614
Total estimated investment is.....	\$88,757,614	\$99,007,614
The machine capacity installed in these two developments in electrical horsepower will be.....	477,000 H. P.	852,000 H. P.
Adequate reserve machine capacity to assure continuity of service should be....	55,000 H. P.	95,000 H. P.
The machine capacity available to meet peak demand on the system will then be	422,000 H. P.	757,000 H. P.
The machine capacity available to the municipalities and companies of the Niagara System, after deducting the commitments of the Ontario Power Company of approximately 108,000 horsepower other than to the Niagara System, will be	314,000 H. P.	649,000 H. P.
The investments per horsepower of total effective capacity with reserve is.....	\$186.00	\$116.00
The investment per horsepower without reserve capacity is.....	\$210.00	\$131.00
Production Costs:		
Interest:		
Queenston-Chippawa	\$3,450,000	\$4,040,000
Ontario Power Co.....	913,000	913,000
Administration, Maintenance and Operation:		
Queenston-Chippawa	344,000	715,000
Ontario Power Co.....	303,000	303,000
Water Power Rentals.....	211,000	389,000
Insurance	30,000	45,000
Renewal Reserves:		
Queenston-Chippawa	750,000	877,000
Ontario Power Co.....	390,000	390,000
Sinking Fund:		
Queenston-Chippawa	1,068,000	1,254,000
Ontario Power Co.....	512,000	512,000
Total Annual Estimated Production Cost.....	\$7,971,000	\$9,438,000
Deducting the contracts of the Ontario Power Co. with others than the Niagara System, amounting to approximately \$1,278,000 per annum, leaves the estimated annual production cost for the Niagara System of.....	\$6,693,000	\$8,160,000
Therefore, the average cost for power production to the municipalities and of the Niagara System at the busses of the generating plants of the Niagara Station for each horsepower-year of machine capacity without reserve is.....	\$21.30	\$12.60
Applying the diversity of 15% used in the previous analyses reduces the cost of power per horsepower-year purchased by the municipalities and companies of the Niagara System, at the delivery points, to.....	\$18.50	\$10.95
To this must be added the cost per horsepower-year for transmission which, for the Niagara System in the fiscal year of 1920, was.....	\$9.40	\$9.40
The total wholesale cost for power per horsepower-year purchased by the municipalities and companies of the Niagara System, when taking power to the extent and under the conditions enumerated above, will then be.....	\$27.90	\$20.35

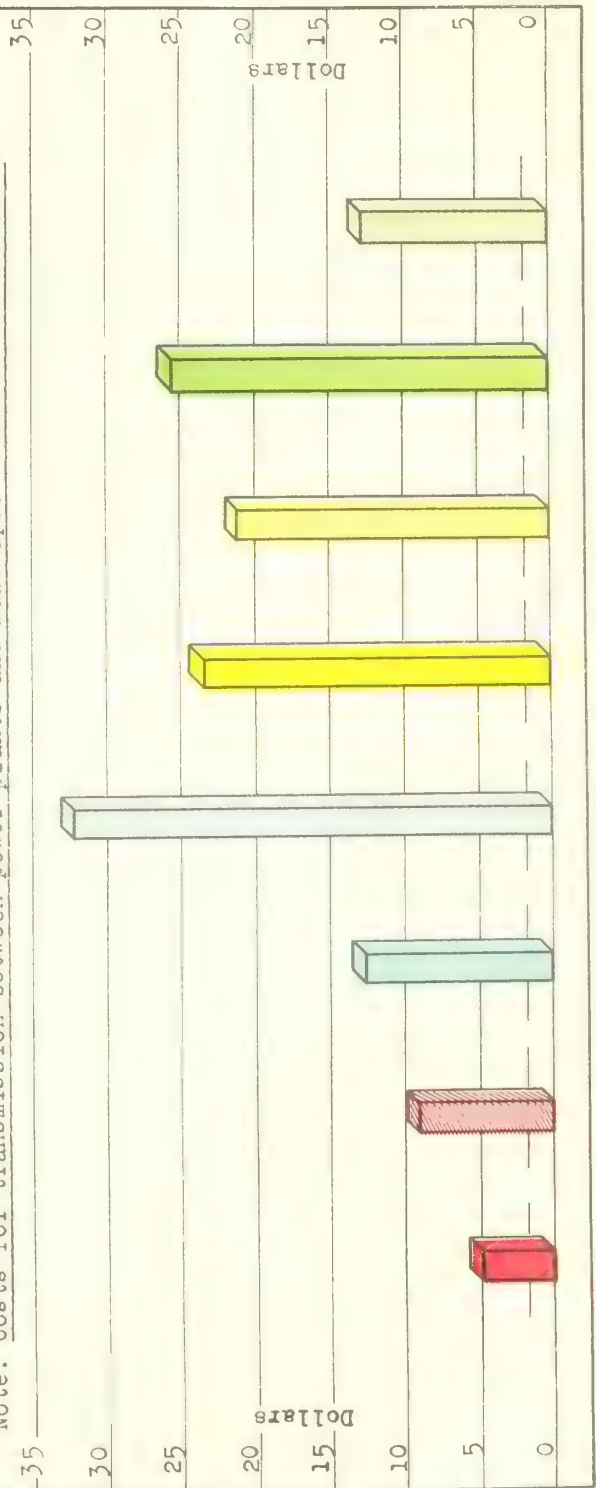
Figure 17

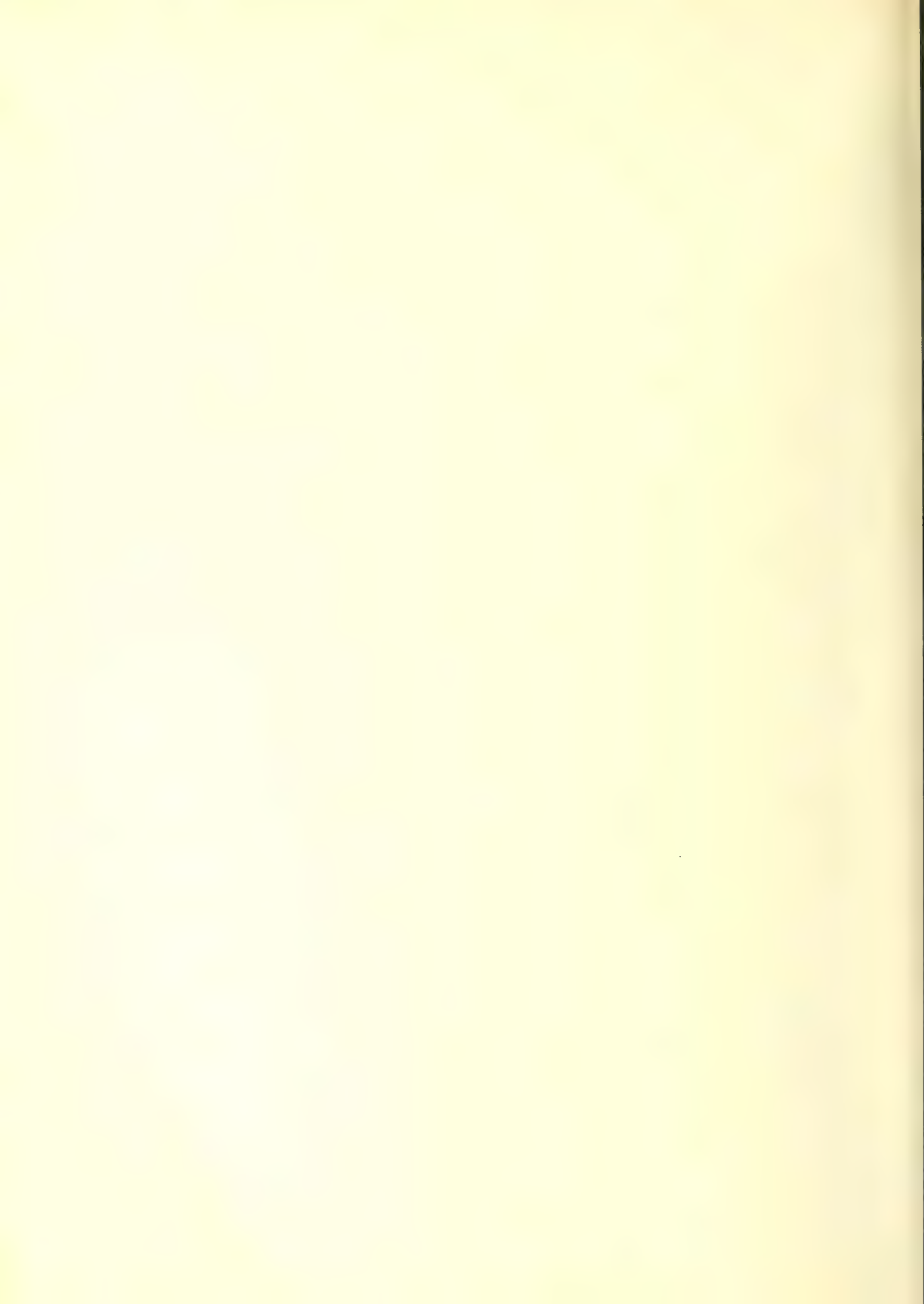
Estimates and Costs for power chargeable to the municipalities of the Niagara System
at busses of generating plants at Niagara Falls.

Legend

- Estimated annual cost from a 100,000 H.P. plant at Niagara Falls by Ontario Power Co. in 1906
- Purchase price paid by H.E.P.C. when buying 100,000 H.P. from Ont. Pwr. Co. under contract 1908
- Production cost for Ontario Power Co. in 1920 as operated by H.E.P.C.
- Estimated annual cost of Queenston plant and Ontario Power Co.
- For load of 275,000 H.P. on Queenston plant with present International Treaty
- For load of 275,000 H.P. on Queenston plant with diversion of 40,000 C.F.S. to each of Canada and United States
- For load of 275,000 H.P. on Queenston plant with unlimited diversion
- For load of 540,000 H.P. on Queenston plant with diversion of 40,000 C.F.S. to each of Canada and United States
- For load of 600,000 H.P. on Queenston plant with unlimited diversion

Note: Costs for transmission between power plants and municipalities are not included.





development of 650,000 horsepower with unlimited diversion amounts to approximately \$360,000 per annum.

None of these figures, however, can be reached until the demand of the Niagara System reaches such magnitude that the Queenston plant will be loaded to the extent above named.

Summarization of the Annual Estimated Cost of Power from the Queenston-Chippawa Development

The Queenston-Chippawa Development will start operating with the restrictions in respect to the use of water provided for in the present International Treaty between Great Britain and the United States. This treaty may later be modified, making available more water for use in the Queenston plant, but not only is this indefinite, but the diversion of water which will be allowed may be greater or less than the 80,000 cubic feet per second recommended by General Taylor in his report to the War Department of the United States.

The estimates of the annual cost for power to the municipalities of the Niagara System, which have previously been given, are based upon three sets of conditions, the first of which is operation under the terms of the present International Treaty, the operating condition of today; the second is that of operating with the diversion of water recommended by General Taylor, and the third that of operating with an unlimited supply of water, a condition which can hardly exist for many years in the future.

Figure No. 17 compares the resulting costs for power chargeable to the municipalities of the Niagara System at the busses of the generating plants at Niagara Falls. It includes no provision

for the costs of transmitting power from the power plant to the municipalities.

In 1906 the Ontario Power Commission estimated it could produce power from a 100,000 horsepower plant constructed at Niagara Falls for \$4.95 per horsepower-year. This cost was never realized, as, instead, the Hydro-Electric Power Commission purchased power from the Ontario Power Co., for which it paid \$9.10 per horsepower-year for 100,000 horsepower. In 1917 the Commission purchased the Ontario Power Company and the cost for power produced therein rose to \$12.70 per horsepower-year in 1920.

With unlimited diversion the cost for power, when the Queenston-Chippawa plant is constructed to a capacity of 275,000 horsepower, will be about \$21.30, an increase of approximately 67% over that of the cost of producing power by the Ontario Power Company in 1920, and when the Queenston-Chippawa Development is ultimately completed and is handling a load of 600,000 horsepower based on the use of 20,000 second feet, provided there is sufficient water available, so that none of the capacity from other power plants on the Canadian side need be shut down, the resulting cost of \$12.60 per horsepower year is about equivalent to that of the Ontario Power Company in 1920, but it probably is greater than what it will cost in future to operate the Ontario Power Company, with the reductions in labor and material that have taken place since that date.

For those conditions where the diversion of water is limited by treaty, and which are the conditions which must be faced in the operation of the Queenston-Chippawa Development, the costs which are higher are given in Figure No. 17.

SECTION G—(Part II)

THE NIPIGON DEVELOPMENT FOR THE THUNDER BAY SYSTEM OF THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO

The Thunder Bay System

The Thunder Bay System, up to about the 1st of January, 1918, consisted of the municipality of Port Arthur, situated in Thunder Bay County, in Western Ontario. The assessed population of Port Arthur for 1920 was 15,094 persons. This section of the Province is very sparsely populated. The only town of any size other than Port Arthur, within reasonable distance, is the City of Fort William, having an assessed population, in 1920, of 19,886 persons. Fort William at present is furnished with its power by the Kaministiquia Power Company, Ltd., a private corporation, while Port Arthur, since the latter part of 1910, has received its power through the Hydro-Electric Power Commission of Ontario, which in turn, contracted with the Kaministiquia Power Company for its supply.

In May, 1917, the Hydro-Electric Power Commission made a new contract with the City of Port

Arthur, which superseded the original contract dated the 13th of January, 1910, and in October, 1917, it also made a contract with the Corporation of the City of Fort William, by which it was at a later date to supply power to that community. Since these dates, it also has contracted with the village of Nipigon, and also with the Nipigon Fibre & Paper Mills, Ltd.

The Commission's Contract with the Kaministiquia Power Company, Limited

The Commission's contract with the Kaministiquia Power Company, dated September 9, 1909, provided among others, the following clauses:

- "Section 1. The Company hereby agrees:
- (a) At the expiration of ninety days' notice in writing from the Commission to the Company, to deliver 1100-horsepower or more of electrical power to the Commission.
 - (b) At the expiration of ninety days' notice.....to deliver from time to time to the Commission in blocks of 100 horsepower.....until the

total amount so delivered shall amount to 10,000 horsepower.

Section 2.

(c)

The Commission agrees:

To pay to the Company for such power.....at the following rates per horsepower per

\$17 up to 2,000 horsepower
Then for all \$16. up to 4000-hp.
Then for all \$15. up to 6000-hp.
Then for all \$14. up to 10,000-hp. or more.

Section 3.

This agreement shall remain in force for ten years from the expiration of the said ninety days' notice. The Commission may, at its option, continue this agreement for one, two or three further consecutive terms of ten years each by giving notice in writing..... at least three years before the expiration of the..... term.

Section 18.

.....The Company shall pay to the Commission for any interruption of less than one hour, double the amount payable for power which should have been delivered during the time of such interruption, and for any interruption of one hour or more, the amount payable for power which should have been delivered during the time of such interruption and five times the last mentioned amount in addition thereto.....

Section 20.

This agreement is entered into subject to the provision of the Power Commission Act, and neither the making of this agreement nor anything herein contained shall, in any way, limit or prejudice any rights or powers which the Commission may now have to expropriate the plant and apparatus of said Company.

Section 28.

Provided this agreement continues so long, the Company shall not, prior to the ninth day of December, 1926, directly or indirectly, supply power to any municipality or to any person, firm or corporation therein while such municipality is supplied by the Commission.....under a contract entered into before the thirty-first day of January 1911 and.... the Commission shall not....supply power to any municipality or to any person, firm or corporation thereon while such municipality is supplied by the Company."

By the terms of its original contract with the Kaministiquia Power Company, Ltd., the Commission delivered power to the municipality of Port Arthur at a cost that could never exceed \$17 per horsepower-year, and which was automatically reduced as the amount of power taken by the Commission was increased, and this feature of the contract gave the municipality of Port Arthur a virtual guarantee that, for at least 10,000 horsepower the maximum wholesale cost of power delivered by the Commission would not, during the next ensuing forty years, exceed \$17. per horsepower.

During the term of the original contract between the Commission and the Kaministiquia Power Company, the following amounts of power were taken by the City of Port Arthur:

Year	Average HP.	Wholesale Cost of Power	Wholesale Cost per HP
1916	2336	\$37,365	\$16.00
1917	2406	38,488	16.00
1918	3835	58,254	16.00
1919	4565	68,406	15.00
1920	5468	81,945	15.00

The horsepower given above is not, however, the total demand of the City of Port Arthur, as this municipality owns a hydro-electric plant of 2,000 horsepower capacity on the Current River, from which it obtains a portion of its energy.

Termination of the Contract with the Kaministiquia Power Co., Ltd.

The first ten-year term of the contract between the Kaministiquia Power Company, Ltd., and the Commission for the supply of energy to Port Arthur expired in December 1920, and it was therefore necessary for the Commission to decide on or before December 1917 whether or not this contract would be renewed.

Prior to that date, that is, on January 1, 1917, the Municipality of Fort William voted to take power from the Hydro-Electric Power Commission, and the Municipality of Port Arthur voted to make a new contract with the Commission, which would supersede the one then existing. In the discussions prior to these decisions the people were informed that by the purchase or expropriation of the Kaministiquia Power Company, Ltd., or by the construction of a new plant, the Hydro-Electric Power Commission would be able to furnish them with power at lower rates than were then in existence in those two cities. The proposal was put to vote and was carried by large majorities in both cities. After the rate-payers of Port Arthur and Fort William had so voted, the Commission offered to purchase the property of the Power Company, but the offer was not acceptable and the negotiations came to nothing. Under the Power Commission Act, and by its contract with the Kaministiquia Power Company, Ltd., the Commission had the right to expropriate the property of the Power Company, the price to be determined by arbitration;

but the Commission elected to construct a hydro-electric plant on the Nipigon River.

The Present Contracts Between the Commission and the Municipalities of Port Arthur and Fort William

Under the new contract between the Hydro-Electric Power Commission and the Corporation of Port Arthur, dated May 7, 1917, it is stated in part:

"WHEREAS.....the Commission intends either to purchase, acquire or construct generating stations, hydraulic plants, lines, sub-stations, and all works in connection therewith, for the purpose of supplying power hereunder, or to enter into an agreement with one or more power generating companies or individuals for a supply of power required hereunder, and to construct the necessary stations, plant, lines and equipment to transmit, transform and deliver said power to the Corporation;"

AND WHEREAS such performances

"Will be made for the purpose of supplying, to better advantage, and with greater efficiency, the power requirements of the various municipalities located in the district of Thunder Bay;"

"AND WHEREAS, in order to meet such changed conditions, it is the intention of both parties hereto that the present power agreement dated January thirteenth one thousand nine hundred and ten be superseded upon its termination by this agreement."

The Commission agrees in part:

(a) "To reserve for and deliver to the Corporation on or before the twenty-sixth day of April, one thousand nine hundred and twenty, 10,000 horsepower or more of electrical power or energy."

The Corporation of Port Arthur agrees, among others:

(b) "To pay annually interest at the rate payable by the Commission, upon the Corporation's proportionate part.....of all monies expended by the Commission on capital account for the acquiring of properties and rights, acquiring and construction of generating plants, transforming stations, transmission lines, distributing stations, and other works necessary for the delivery of said electrical energy or power to the Corporation under the terms of this contract."

"And to pay annually a sinking fund installment of such an amount as to form, at the end of forty years, with accrued interest, a sinking fund sufficient to repay the Corporation's proportionate part, based as aforesaid, on all monies advanced by the Province of Ontario....."

(d) "To take electric power exclusively from the Commission during the continuance of this agreement."

(f) "To pay as a minimum for three-fourths

of the power ordered from time to time by the Corporation, and held in reserve for it....."

4. "This agreement shall remain in force for forty years from the expiration of the said agreement between the parties hereto, and dated the thirteenth day of January one thousand, nine hundred and ten."

8. "It is hereby declared that the Commission is to be a trustee for all property held by the Commission, under this agreement, for the Corporation or Corporations supplied by the Commission; but the Commission shall be entitled to a lien upon such property for all monies expended by the Commission under this agreement and not repaid."

Mr. Clarkson, in his audit of the accounts for the Hydro-Electric Power Commission, for the year ending October 31, 1918, states with reference to the new arrangements with Fort Arthur and Fort William made by the Commission in 1917:

"The terms of repayment by these municipalities of the capital invested in the works of the system extend over a period of forty years. This is a variance with Section 23 of the Act, which provides that every municipal corporation under contract with the Commission shall pay to the Commission, as a part of the costs of power delivered, its proportion of an annual amount sufficient to form, in thirty years, a sinking fund for the repayment of the advances made by the Province."

The contract does not indicate the maximum price which the municipality of Port Arthur is to pay for power, and, in this respect, differs from the Schedule A contracts between the Commission and the various municipalities of the Niagara System executed from time to time.

On October 19, 1917, an agreement was executed between the Hydro-Electric Power Commission and the Corporation of the City of Fort William, which, in most respects, is similar to that between the Commission and Port Arthur. The following differences appear:

The Corporation of Fort William agrees, in part:

(d) "To take all electric power or energy in excess of that required to be taken under said power agreement with the Kaministiquia Power Company, Ltd. from the Commission, during the remaining life of said agreement; to cancel and terminate, at their expiration, the said agreements with the Kaministiquia Power Company, and thereafter take electric power exclusively from the Commission for the life of the within agreement. Nothing herein contained shall be construed to compel the Corporation, during the remaining life of the said agreements with the Kaministiquia Power Company to order part of its power from the

Commission, unless the quantity desired to be supplied can be supplied by the Commission at a cost equal or better than the cost of power from the Kaministiquia Power Company, as set forth and contained in the present agreements with the corporation, dated 1905 and March 14, 1916."

The agreement is similar to the Port Arthur agreement in that it calls for a contract life of forty years and permits the municipality to retire its portion of the investment through a sinking fund over a period of forty years.

In March 1916, the Kaministiquia Power Company, Ltd., reduced its rate to the municipality of Fort William to \$20. per horsepower-year for power delivered on the city's bus bars at 2200 volts, and it is thus apparent that unless the Commission can sell power to the municipality of Fort William from the Nipigon Development for less than \$20. per horsepower-year, that the municipality is not bound until after December 1926 to take any power from the Commission.

Power Available from the Kaministiquia Power Company

Mr. Gaby, in answer to the question as to why the contract with the Kaministiquia Power Company, Ltd., was discontinued, stated:

"The contract between the Commission and the Kaministiquia Power Company expired on December 20, 1920, and this contract was discontinued because the Kaministiquia Power Company did not have sufficient power available to supply the requirements of the district. The municipalities notified the Commission not to extend the contract."

The 1920 Annual Report of the Hydro-Electric Power Commission also says:

"During the past ten years power has been supplied to Port Arthur by the Commission under a contract for power received from the Kaministiquia Power Company, Ltd. This contract expires in December 1920, and at the request of the municipalities in this district, the Commission commenced construction of a development on the Nipigon River at Cameron Falls in the Fall of 1918."

On the other hand, investigation discloses that the Kaministiquia Power Company, having a plant capacity of 35,000 horsepower at Kakabeka Falls in 1917, had available at that time 15,000 horsepower of excess capacity which was not then contracted for, and in addition owned the rights on the Kaministiquia River for other developments of a capacity equally as large as that at Kakabeka Falls.

The Dominion Water Power Branch of the Department of the Interior of Canada reports that the Nipigon River at Cameron Falls has a drainage

area of 8,940 square miles and that the Commission's development at this point will operate under a head of 72 feet. The Water Power Branch further states:

"No storage by artificial means is maintained in the Nipigon watershed."

The same authority also states that the Kaministiquia River at Kakabeka Falls has a drainage area of 2,805 square miles, and that the plant of the Kaministiquia Power Company Limited at that point operates under a head which varies from 175 to 185 feet. It further brings out that the Kaministiquia River is served by a storage reservoir at Dog Lake, having a surface area of 53 square miles and a storage capacity of 28,000,000,000 cubic feet, and that the estimated regulation of this reservoir amounts to 630 cubic feet per second at the outlet of the lake. The information with regard to the storage reservoir was furnished to the Water Power Branch by the Hydro-Electric Power Commission of Ontario.

Comparing the above given characteristics of these two rivers, it appears that the ratio of firm power to installed capacity for the Kaministiquia Power Company for its present capacity of 35,000 horsepower is somewhat better than for that of the proposed ultimate development of 75,000 horsepower at Cameron Falls on the Nipigon River. It is understood that there are sites for additional storage reservoirs on both rivers, which can be constructed when business requirements warrant the capital expenditure.

Mr. Gaby, in the answers given in Section A states:

"The maximum demand for Port Arthur in December 1920, furnished by the Hydro-Electric Power Commission was 6,950 horsepower,"

while Mr. Pierdon, the Accountant of the Commission, gives the maximum demand for the fiscal year of 1921 as 8,100 horsepower for the month of February.

The Commission had the right to contract for 10,000 horsepower under its contract with the Kaministiquia Power Company, and thus, three years after the termination of this contract by the Commission, the maximum demand for Port Arthur was about 3,000 horsepower less, and four years after the termination was about 2,000 horsepower less than that which the Commission had the right to take from the Kaministiquia Power Company by the terms of its contract.

Since the termination of the contract between the Kaministiquia Power Company and the Hydro-Electric Power Commission, the Power Company has contracted with the Fort William Paper Company to supply it with power, and is delivering over 6,000 horsepower to that company for a pulp-mill load, which has a characteristically high load factor.

Quality of Service Given by the Kaministiquia Power Company

The service rendered by the Kaministiquia Power Company, Ltd., in supplying current to the Commission would appear to have been satisfactory from comments given in the Commission's Annual Reports, some of which are as follows:

"There were especially few interruptions and no failures of the station equipment have been reported." Annual Report, 1915, Page 112.

"The Company's power supply to the Commission during the year was of the usual high standard." Annual Report, 1916—Volume I, Page 154.

"The Commission received first-class service from the Kaministiquia Power Company, Ltd. during the year." Annual Report 1917, Volume I, Page 107.

"The quality of the service supplied by the Kaministiquia Power Company, Ltd. was entirely reliable." Annual Report 1918, Volume I, Page 145.

"The operation of the Thunder Bay System has continued to be very satisfactory during the year." Annual Report 1919—Volume II, Page 14.

"The Kaministiquia Power Company, Ltd. have maintained a very good standard of service." Annual Report 1920—Volume I, Page 132.

Justification for the Nipigon Development

Inasmuch as, by the Commission's own statements, the service received from the Power Company was satisfactory, and as the evidence indicates that there was ample power available for the municipalities of Fort William and Port Arthur at all times, it would seem that the only justifiable reason for going into the Nipigon Development would be that of reducing the cost of power to these two municipalities, and as the preamble to the contracts with each of these municipalities specifically states that such is the purpose of the contract, did the Commission use good judgment in starting the construction of the Nipigon Development on behalf of the municipalities at the time it did?

It is evident that at the time the Commission started work on the Nipigon project, that is, in 1918, it felt that the development would be one which could be cheaply constructed. This is brought out by Sir Adam Beck's statement before the Committee on Water Power of the House of Representatives in Washington, on April 15, 1918:

Mr. Hamilton: "Now is the development of Niagara to cost less per horsepower than the development of smaller powers?"

Sir Adam Beck: "Yes, it costs less than some

of them, but not all of them. Between Lake Nipigon and Lake Superior there are two developments totaling 135,000 horsepower that compare favorably with Niagara or cheaper."

Description of the Nipigon Development

The Commission evidently was considering the Nipigon Development prior to 1917, as the annual report for that year, Volume III, Page 2, states:

"In October, 1917, arrangements were made for surveys on the lower power sites on the Nipigon. . . . From data now available, it is expected . . . the survey will demonstrate the feasibility of a development below Cameron's Pool . . . with a possible ultimate capacity of 100,000 horsepower."

Sir Adam Beck, in his 1920 report states:

"Construction was actually commenced in 1918."

The 1919 annual Report of the Commission describes the development as finally decided upon.

"This development is being installed on the Nipigon River at Cameron's Falls, about 15 miles above Nipigon Village on the Canadian Pacific Railway. The drainage area of the river at this point is 9,100 square miles. . . ."

"Owing to the inaccessibility of the power site, it was found necessary to build a standard gauge railroad, approximately one mile in length. . . ."

"A dam consisting of a gravity section with about five sluices will ultimately be installed. . . ."

"The turbines are 12,600 horsepower . . . operating under 72 feet head. . . . The present installation will consist of two units, but will ultimately be six."

"Early in the year, surveys were undertaken for a 110,000 volt transmission line between Cameron's Falls on the Nipigon River and the terminal cities of Port Arthur and Fort William. Work was undertaken in the Spring of 1919 on a 110,000-volt wood pole line.

"This line is 69 miles long, and it is intended that it should deliver from 17,000 to 30,000 horsepower to the terminal cities.

"The initial installation (Port Arthur-Nipigon Transformer Station) will consist of one (1) 110,000-volt line equipment; four (4) 4000-Kva. single-phase, water-cooled transformers and four (4) 22,000-volt feeder equipments."

Power Contracts Held by the Commission

In going into this development the Commission apparently possessed signed contracts for a total of only 13,000 horsepower, and of this it could hold the municipalities of Port Arthur and Fort William responsible for only 9,750 horsepower under the terms of the contracts. At about the time the Commission started the Nipigon Development, the Province made certain concessions known as the "Sturgeon Timber Concession" to Mr. J. J. Carrick, who later transferred these to Mr. L. L. Alsted, who, in turn, formed the Great Lakes Pulp & Paper Company, and the Commission was in hopes of obtaining from that company a contract for 20,000 horsepower for use in this pulp mill. However, the Great Lakes Pulp & Paper Company never entered into a contract with the Commission for the purchase of power and as late as 1920 was negotiating with the Kaministiquia Power Company for a supply of power, which contract they were unable to consummate, as the Kaministiquia Power Company, Ltd., meantime had contracted with the Fort William Paper Company for the larger portion of its surplus power, including that then being supplied to the Hydro at Port Arthur.

The City of Port Arthur made a contract with the Kaministiquia Pulp Company, which commenced operation in February, 1921, but which operated only for six weeks and has been closed down since that time. This contract was for not less than 1500 horsepower, nor more than 3000 horsepower for a period of ten years, at a rate of \$1. per horsepower per month of maximum demand, plus 1.75 cents per kw-hr. for the first fifty hours used per month of maximum demand, plus 1 cent per kw-hr. for all current used in excess thereof. This contract carried a 15% discount for 22,000 volts delivery.

In addition to this, the Hydro-Electric Power Commission has contracted to supply the Village of Nipigon, but as yet has not started to deliver it power. It also was supplying the Nipigon Fibre & Paper Mills, Ltd., located at Nipigon, with between 3000 and 4000 horsepower up to about December, 1921, when that mill was closed, and operations have not been resumed. Power was sold to the latter company at 110,000 volts at a price quoted as \$24. per horsepower for the first 4000 horsepower year, \$22 per horsepower for all power up to 6000 horsepower, \$21 per horsepower year for all power up to 8000 horsepower, and \$18.50 per horsepower year for all power up to 10,000 horsepower year or in excess of that amount. This contract was for a term of ten years and evidently is the contract referred to by Mr. Gaby in his answers to the questions relative to Nipigon contained in Section A.

It should be understood that none of these contracts, except those with the municipalities of Port Arthur and Fort William, was signed at the time the Nipigon project was inaugurated.

Estimated Cost of the Nipigon Development

The only estimated cost on the Commission's records prior to the statement made by Mr. Gaby

is contained in the Clarkson report for the year ended October 31, 1919. Mr. Clarkson, in that report, states:

"In the Fall of 1918, the Commission commenced construction of a power development on the Nipigon River which, according to estimates of engineers of the Commission, is expected to cost between \$4,000,000 and \$5,000,000 when complete. The amount of power to be generated by the development will be considerably in excess of the requirements of the Cities of Port Arthur and Fort William, with which contracts have been executed and approved by the Legislature. The Commission contemplates the sale of this excess power to pulp and paper mills, but to this point contracts covering the same have not been executed. Certain issues exist with regard to the sale of such power and the probable cost of power to the Cities of Port Arthur and Fort William and the attention of the Government, the Commission and municipalities is now directed toward the same."

With regard to the cost of the Nipigon Development, the following is stated in the Commission's Annual Report for the fiscal year of 1920:

"The work of constructing this plant was held up considerably on account of adverse conditions of labor and material, with a consequent increase in capital cost, and as the Commission was advised by the Kaministiquia Power Company, Ltd., that this contract could not be temporarily extended beyond the date of expiration . . . it was therefore necessary to rush the construction to completion with a resulting increase in the expenditure over the estimated cost of completing this work under normal conditions."

Mr. Gaby, in his answers to the questions in Section A, states:

"The original estimated cost of the generating station, including step-up transformers of 110,000-v. for 30,000 horsepower, transmission lines, 65 miles in length, 110,000 volt step down transformer station in Port Arthur for 30,000 horsepower, on conditions obtained during construction as submitted to Government—\$6,472,479."

Mr. Gaby further states that:

"The amount spent on the Nipigon Development to October 31, 1921, was \$6,387,136.56 and that all the work as provided for in the estimates was completed as of that date with the exception of stripping forms off a part of the concrete on the dam."

The total investment of the Commission on the

Thunder Bay System as of October 31, 1921, inclusive of both the Nipigon Development and the investments previously made in transmission lines and sub-stations, according to Mr. Pierdon, the Commission's Accountant, was \$6,477,212.01. Neglecting all variations in the above figures, and using Mr. Gaby's statement as to the estimated cost for a 30,000 horsepower development, namely \$6,472,479 the investment cost per horsepower for such a development would be \$216. and the annual cost of power delivered to the municipalities of Fort William and Port Arthur would have been about \$22.00 per horsepower-year, allowing about 10.2% of capital expenses for all operating and fixed charges, providing no allowance for reserve equipment, but providing for the ratio between average horsepower paid for and the capacity of the plant. This is \$2.00 per horsepower-year in excess of what the municipality of Fort William is now paying to the Kaministiquia Power Company, Ltd., and \$7.00 per horsepower-year in excess of what the Commission was paying for power delivered to Port Arthur from the same company.

Acting as trustee for the municipalities of Port Arthur and Fort William, it was evidently the judgment of the Commission that the construction of the Nipigon Development was for their best interests, notwithstanding that at the time they started this development, the prices of material and labor were high and were mounting, and that Canada was involved in the World's War and could readily utilize all capital available for the consummation of its war requirements. The situation was one which could have readily been deferred until materials and labor prices had decreased, as not only was power sold to these two municipalities at the time at a reasonable and even low price, but there was no urgency for additional capacity for the purpose of turning out munitions, such as existed around the big industrial sections at Hamilton and Toronto.

The Estimated Annual Cost of Power to Port Arthur and Fort William

On the basis of the work completed to October 31, 1921, the Commission, both in the old and new facilities, had invested \$6,477,212.01 in the Thunder Bay System, and this investment is used as the basis of estimating the cost of power to Port Arthur and Fort William.

During the fiscal year of 1921, after the Kaministiquia Power Company, Ltd. ceased to deliver power, the power was furnished to Port Arthur by the Nipigon Development. The loads upon this development, as furnished us by Mr. S. Richardson of the Operating Department of the Commission, varied from a peak load of 6800-kw. in January 1921 to 9200-kw. in October 1921 and of this peak that delivered to Port Arthur varied between 4200-kw. in June 1921 to 5520-kw. in October of the same year.

In the same statement, Mr. Richardson gives the nominally installed capacity of Nipigon in kilowatts as 10,600-kw. for the months of December 1920

and January 1921, and for the balance of the year as 21,200. However, of this he states that there was available only 6600-kw. for the first two months and 13,200-kw. for the balance, as the plant was operating under a lower head than that for which it was designed, and will do so until the completion of the dam.

At the time the Nipigon Plant began operating, the Commission had three contracts signed for the use of power. Those with Port Arthur, Fort William and the Nipigon Fibre & Paper Company. Port Arthur started to take power in December 1920 and the Nipigon Fibre & Paper Company started to take power in about May 1921, but as yet Fort William has taken no power upon its contract.

The contract with the Nipigon Fibre & Paper Company dated October 1, 1921, guarantees to the Commission a minimum of 3000-horsepower and the Commission agrees to reserve power for the use of the company in blocks of 1000-horsepower up to a maximum of 8000-horsepower. During the year, this company was charged with a minimum load of 3016-horsepower and a maximum of 4090.8-horsepower in the month of September. We are informed by Mr. Richardson that this plant at the present moment is completely closed down and is taking no power from the Commission. The average amount of power taken by the company during the six months it operated in 1921 was 3520-horsepower.

The average horsepower taken by Port Arthur from the Commission during the fiscal year of 1921 varied monthly from a minimum of 5824-horsepower in June to a maximum of 7399-horsepower in October, the average for the year being 7030.09-horsepower.

Using as the estimated cost of the development, the actual investment of the Commission as of October 31, 1921, the operating costs should be approximately as follows:

Interest	\$402,000 ✓
Administration, maintenance and operation for plant.....	50,000 ✓
Line and sub-station operation.....	20,600 ✓
Renewal Reserve	80,900 ✓
Sinking Fund Reserve.....	115,000 ✓
	<hr/>
	\$668,500 ✓
Credit for power sold to the Nipigon Fibre & Paper Company—3520 horsepower @ \$24.....	84,500
	<hr/>
Net cost of power delivered to Port Arthur	\$584,000

Interest has been taken at the rate specified, inasmuch as Mr. Pierdon states that it is the Commission's intention to have the Thunder Bay System stand on its own feet. The operating costs for the plant are based on the operating costs for the Ontario Power Company, and for lines and substations,

have been based on the analysis of the cost of such operation in the Superpower Report, while the rates used for renewal reserve are also based on the rates used in that report, with a 4% improvement on money, instead of the 7% improvement, as used in the Superpower Report.

Port Arthur in 1921 purchased an average of 7030-horsepower from the Commission and this, when applied to the cost of power chargeable to it under the Power Commission Act, makes Port Arthur liable for power at the rate of \$83.00 per horsepower-year.

During the year of 1921, however, the Commission charged Port Arthur an interim rate of \$19.75 per horsepower-year plus \$517.22 per month. The latter item of this rate is to cover interest and sinking fund on investments made by the Commission on low tension equipment for the municipality of Port Arthur. It should also be noted that the contract for the municipality of Port Arthur is on the basis of that municipality taking 10,000 horsepower, under which agreement it should pay for a minimum of 75% or 7,500 horsepower. This has not been done for the year of 1921.

Crediting the \$584,000, chargeable to the municipality of Port Arthur for power from Nipigon development in 1921 with the interim rate quoted, which totals \$203,707, leaves an excess cost of power to the municipality of Port Arthur of \$380,293, to be billed against them in the 13th bill, providing the Power Commission Act is strictly adhered to.

The capacity of the present installation at Nipigon is 25,000 horsepower in two units and neglecting the question of adequate reserve, it is estimated that this plant could sell an average of 20,000 horsepower per annum from which to derive revenue. Port Arthur and Fort William, were they to take their quotas contracted for in 1917, would absorb 13,000 horsepower of this, leaving 7,000 horsepower to be sold to the Nipigon Fibre & Paper Company if it should again resume operations. Crediting the total estimated annual cost of operating of \$668,500, with the sale of 7,000 horsepower to the Paper Company at \$21.00 per horsepower year or \$147,000, leaves \$521,500, chargeable to the municipalities of Fort William and Port Arthur, which would be at the rate of \$40.10 per horsepower-year, providing they took the 13,000 horsepower contracted for. This rate would be \$20.10 in excess of the \$20.00 per horsepower-year rate now being paid by the municipality of Fort William to the Kaministiquia Power Company, Ltd., and would be about \$21.20 per horsepower-year in excess of the interim rate that Port Arthur might expect to earn under its old contract when taking 10,000 horsepower. The annual increased cost of power to these municipalities under the conditions of the Nipigon development fully loaded to its present capacity, would amount to about \$60,300, for Fort William and \$212,000, for Port Arthur.

Not considering investments in the facilities for Port Arthur under the old agreement, nor considering the added investment required to deliver power

to Fort William from the present transformer station at the terminus of the Nipigon Line, it is estimated that the cost to complete the Nipigon Development with adequate transmission lines and sub-station equipment so that the entire development will have a capacity of 75,000 horsepower, is \$9,386,500. This figure is based on the estimates given by Mr. Gaby plus the necessary additions to bring the installation from 25,000 horsepower up to its ultimate capacity. The annual operating cost on the ultimate installation under this condition is estimated to be as follows:

Interest	\$586,000
Plant Administration, Operation and Maintenance	150,000
Operation of Lines and Substations.	26,000
Renewal Reserve	117,000
Sinking Fund	210,000
Total	\$1,089,000

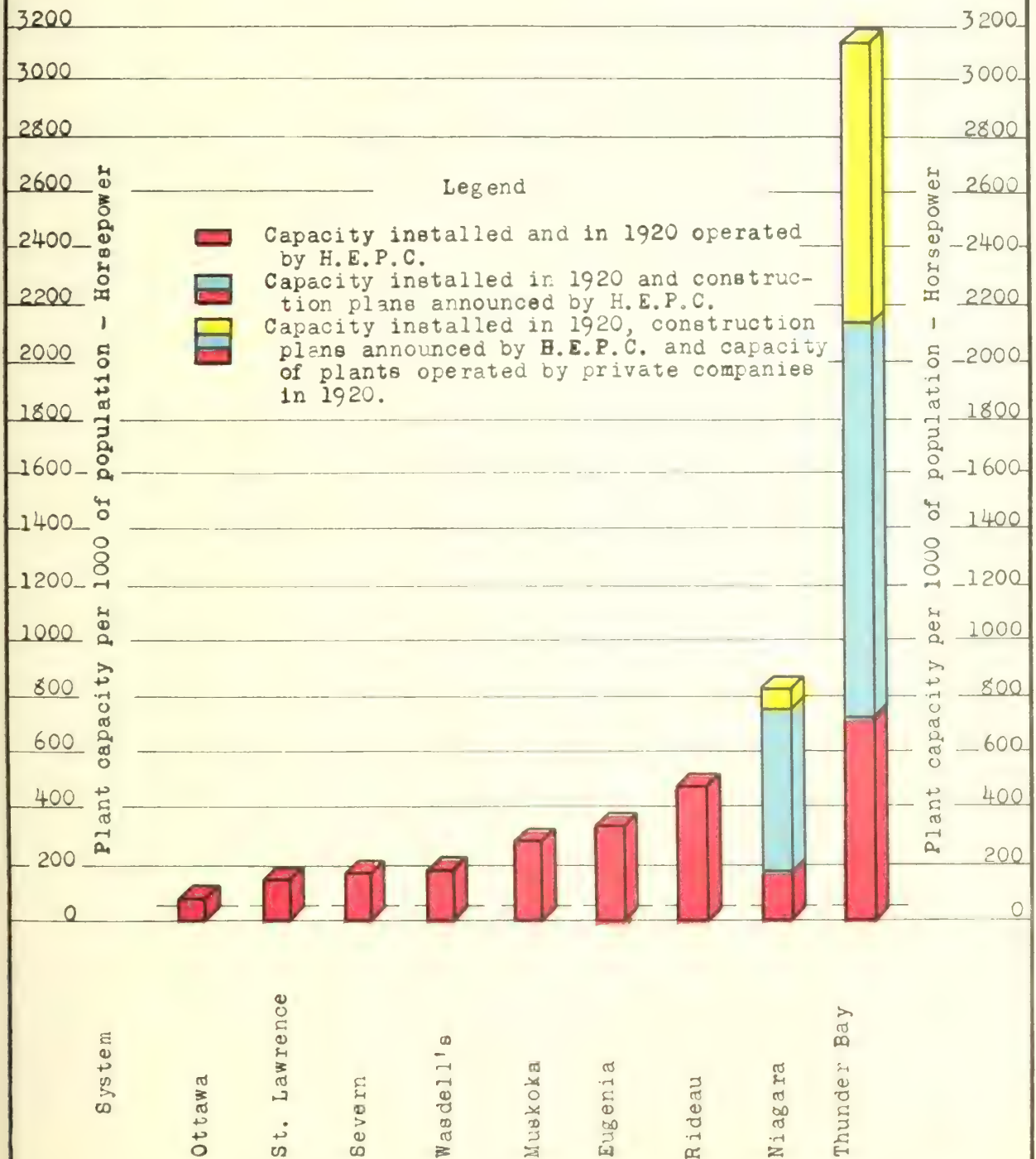
From Mr. Gaby's statement in Section A, it is apparent that the Commission believes that the Nipigon Fibre & Paper Company will ultimately take 16,000 horsepower. Crediting this total annual sale of 16,000 horsepower at \$18.50 or \$296,000 leaves \$793,000 as the portion of the cost to be borne by other consumers. The commercial output of the plant should be about 60,000 horsepower of salable power and after deducting the 16,000 horsepower assumed to be taken by the Nipigon Fibre & Paper Company, there is left 44,000 horsepower available to other consumers at a cost of \$793,000 which would bring the net cost at \$18.03 per horsepower-year.

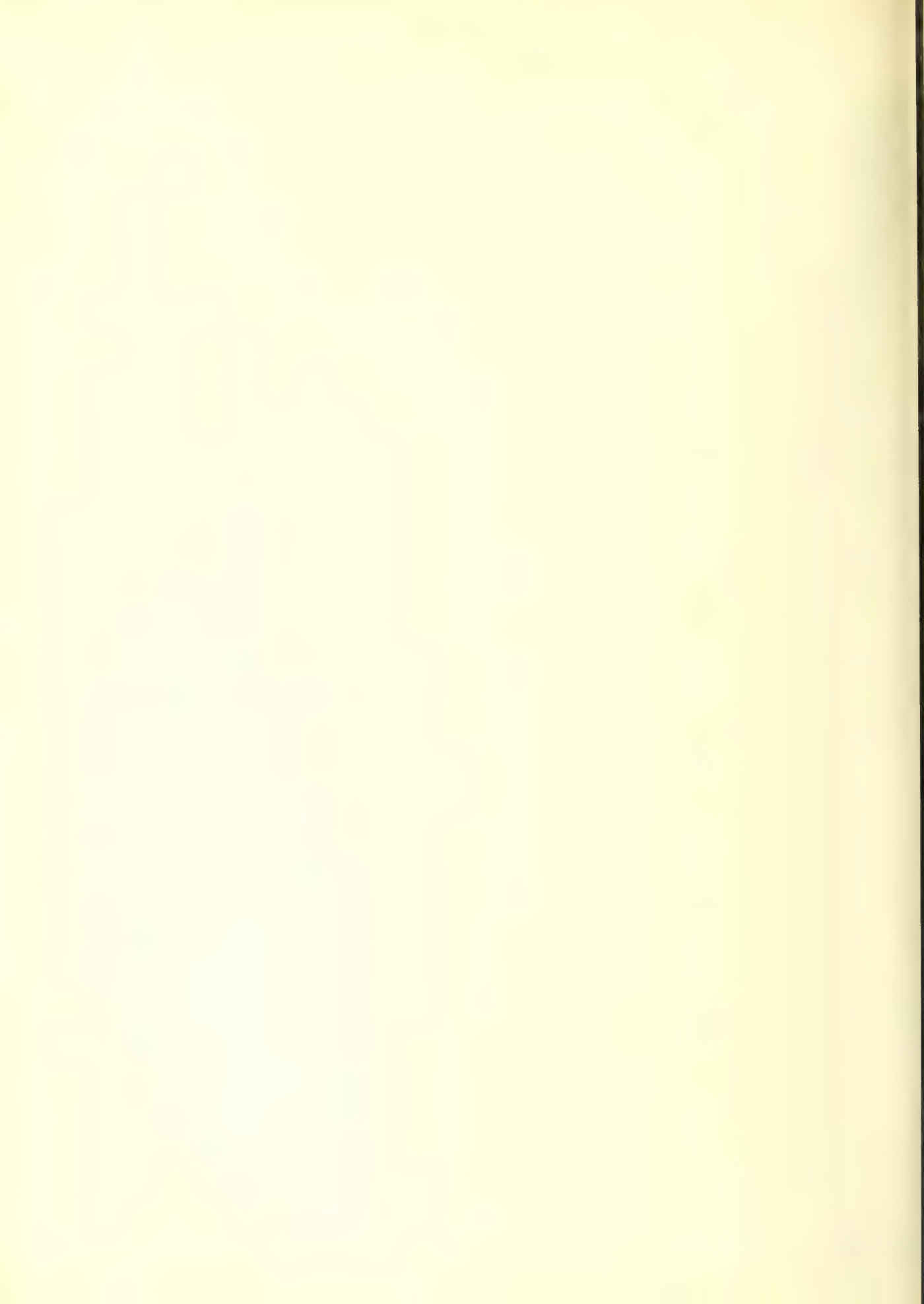
Under its contract with the Kaministiquia Power Company, Limited, the Commission could purchase power in quantities of 6,000 horsepower or more, for \$14.00 per horsepower per annum, so that the excess cost to Port Arthur, even under the ultimate development, will be in the neighborhood of \$4.03 per horsepower-year. If Fort William should take power, the cost of it would be \$1.97 per horsepower-year less at the Port Arthur Terminal than it is now paying for 2,200-volt power delivered on its own bus bars. As to whether the cost of the line between the terminal transformer station at Port Arthur and Fort William, together with the cost of transforming down to 2,200-volt, would absorb all of this gain, it is impossible to say with the data at hand.

The above three comparisons as to the annual cost of power to the municipalities of Port Arthur and Fort William bring out that, until the Nipigon Development has been built up to its ultimate capacity, there is no possibility of approaching the costs of power enjoyed by these municipalities before the Nipigon Development was gone into and it will be interesting to learn how the excess cost of these municipalities will be dealt with by the Commission until such time as the ultimate development is reached.

Figure 18

The power plant capacities available to the people of the several systems served by the H.E.P.C.





Comparison of the Capacity, per Capita, Installed for the Thunder Bay System to That for the Other Systems of the Hydro-Electric Power Company

The population served by the Hydro-Electric Power Commission on the Thunder Bay System, including Fort William, is about 35,000 persons. The present capacity of the Nipigon plant of 25,000 horsepower gives a capacity of 715 horsepower for each 1,000 of population, while the ultimate capacity of 75,000 horsepower will give more than 2,000 horsepower of capacity available to each 1,000 of population.

The Kaministiquia Power Company has also 35,000 horsepower to be disposed of in this same district, so that the combined capacity of the present Nipigon Development and that of the Kaministiquia Power Company amounts to about 1,700 horsepower for each 1,000 of population, and the combination of the ultimate development at Nipigon, and the present development of the Kaministiquia Power Company will amount to more than 3,000 horsepower for each 1,000 of population.

Figure No. 18 shows the relative amounts of capacity which the Commission has made available to each of its several systems in the year 1920. The capacity available to the Niagara System given in the figure is inclusive of the power purchased from the Toronto Power Company and the Canadian Niagara Power Company, but is exclusive of the power exported to the United States by the Ontario Power Company.

The power for the St. Lawrence System and the Ottawa System is entirely purchased and does not contain any capacity owned by the Commission.

Comparing the power available to the Thunder Bay System with that of the other systems, shows it to be nearly twice as great as the Muskoka System, which is nearest to it in the amount of power available per capita, and to be over four times as great as that available to the Niagara System from the power facilities of the Commission. Considering all of the power capacity available to the Thunder Bay District, whether owned by private corporations or Governmental agencies, the amount available is nearly five times that available from all sources, both private and Governmental, to the Niagara System, at the present time, and on the basis of the ultimate proposed development for Nipigon and Chippawa, the amounts of power available to the Thunder Bay District per capita will be nearly four times as great as that to the Niagara District.

The Results of the Nipigon Development

It would seem from what has been previously brought out that the Hydro-Electric Power Commission not only used poor judgment, from a financial standpoint, in going into the Nipigon Development when they did, but from an engineering standpoint, its judgment does not seem to have been of the best in tying up an important municipality such as Port Arthur to a power plant located 69 miles away with

only a single circuit 110,000-volt wooden pole line running through a very sparsely settled district.

The citizens of Fort William and Port Arthur are apparently alarmed at the cost of power confronting them should the Power Commission Act be rigidly adhered to and both of these cities have sent delegations to Toronto to endeavor to obtain relief. At a meeting between the Utilities Committee of Fort William and Mr. T. E. James, Representative of the Hydro-Electric Power Commission on October 5th, 1921, Mr. C. E. Chapple, Chairman of the Utilities Committee, said that the Hydro-Electric Power Commission held out as an inducement to the city before the by-law was passed that the price of power, then \$20.00 per horsepower-year, would be reduced, but since that time every estimate as to the cost of power had been worse than the last until it had reached a price of \$25.00 per horsepower-year. It was said at this meeting that the Commission had promised to submit a firm price for power in writing to the city of Fort William, but that such had not as yet been done.

Mr. James, the Commission's representative, stated at the meeting that he had received a wire from the Commission, saying that the price of power to Fort William and Port Arthur was to be at a rate of \$25.00 per horsepower-year based on a delivery of 40,000 horsepower, which, he said, was to cover all costs, including duplicate transmission lines from Nipigon. Mr. James further stated that the interim rate quoted to the Village of Nipigon would be \$36.00 per horsepower-year for 10,000 horsepower.

Premier Drury, expressing himself with regard to the recommendation of a flat rate for power delivered in Fort William from the Nipigon Development, said in an address made during July 1921, that it would be an exceedingly dangerous precedent to establish. He also said:

"I am not sure that I have the solution to the problem, but it is a situation that must be met. The Government must meet the problem. I am not sure that it would be met by the Province assuming the liability. Someone, I must say, has been guilty of lack of foresight in this development. It is a development, I believe, beyond your situation. Fort William, by a vote of its citizens, committed itself to the plan. There must not be talk now of 'kicking over the traces.' I am sure a solution will be found in a much better way."

The Premier was referring to the possibility of the Province taking over the Nipigon Development and wiping out a part of the cost thereof, in order that power could be sold to the municipalities at a rate nearer to what they had been paying in the past. Such a plan, however, would subsidize the Hydro-Electric Power Commission and would make the general tax-payer of the Province of Ontario pay by taxes a portion of the interest and other fixed charges which, by the Power Commission Act, should be directly met by the power consumer.

SECTION H—PART II

RATES FOR POWER TO THE PEOPLE OF ONTARIO USING HYDRO-ELECTRIC POWER SERVICE AND COMPARISONS OF THE RATE-MAKING METHODS EMPLOYED BY THE HYDRO-ELECTRIC POWER COMMISSION TO THOSE OF THE CALIFORNIA RAILROAD COMMISSION

Powers of the Hydro-Electric Power Commission with Respect to the Regulation of Rates

By the Power Commission Act and its amendments the Hydro-Electric Power Commission is given authority to:

- (a) Adjust the wholesale rates to the several municipalities taking power, at the end of each year, so these rates shall represent each municipality's proportional cost for the service;
- (b) To make and regulate the retail rates that shall be charged by the Municipal Commissions to the individual customers taking power therefrom;
- (c) To make rates to companies located without the precincts of the municipalities, and with the permission of the Municipal Commissions, to make rates to companies located within municipal precincts.

The Power Commission Act does not grant the Hydro-Electric Power Commission any authority over the rates that shall be charged by power companies privately owned and operated.

The Several Classes of Rates for the Governmentally Owned Electric Utilities in the Province of Ontario

In discussing the rates charged by the government electric utilities of Ontario, a very clear conception must always be borne in mind as to which class of rate is under discussion. As is brought out in the opening paragraph of this section, the Hydro-Electric Power Commission wholesales power to the municipalities, who in turn retail power to the individual customers. The Commission further retails power to individual industrial companies, particularly where such companies are not located within the boundaries of the municipalities.

In making comparisons between the rates in force for the government electric utilities in Ontario and those for private companies, located either within Canada or in the States, it is not uncommon to see the wholesale "interim" rate charged by the Commission to the municipalities compared with the rate charged by private companies to their ultimate consumers. This, of course, is an erroneous comparison and could lead to the belief that the rates charged by the government electric utilities of Ontario are much lower than they are in fact.

Wholesale Interim Rates

The Power Commission Act provides that power shall be sold at cost to each of the several municipi-

palities, taking power from the Hydro-Electric Power Commission. In order that the municipalities may be billed monthly for power used, the Hydro-Electric Power Commission estimates the cost of power per horsepower-year to each municipality, and bills at the end of the month the several municipalities on the basis of this estimate, which is termed in the Annual Reports and other documents of the Commission the "Interim Rate." Municipalities purchase power from the Commission on the basis of the maximum twenty-minute peak for each month; however, where a municipality takes less than 75% of the amount of power contracted for, it is billed for 75% of the contracted amount of power.

At the end of the year the Hydro-Electric Power Commission determines each municipality's proportion of the investment, and operating cost for the system. The cost so determined may be greater or less than the amount that has been paid for power on the basis of the interim rate, and a thirteenth bill is then rendered to each municipality, in which it is either credited or charged for the difference between what it has actually paid and what its actual proportion of the total operating cost is found to be.

Rate-making Methods Employed by Hydro in Ontario and by the Railroad Commission of California

Both the Hydro-Electric Power Commission and the California Railroad Commission determine rates for power upon a cost basis. Cost includes, in each instance, operating, maintenance, administrative expenses, allowance for depreciation and obsolescence and the cost of money. In addition to these, all taxes are charged against cost by the Railroad Commission of California, but the Hydro-Electric Power Commission charge against cost only those taxes levied against lands. It does not include any tax against structures or equipment, as such are exempt from taxation under the law of Ontario.

In general, these two rate-making methods are the same. The resulting average rate for any system to which these two methods are applied differ only as they are affected by applying the cost of money and taxes.

Properties operated by the Hydro-Electric Power Commission of Ontario, and by the municipalities contracting with it are financed entirely by the issuance of bonds, with the exception that in certain cases the Commission has assumed the bonds of private companies which it has purchased.

The Commission receives money directly from three sources:—first, from the Provincial Treasurer in the form of cash, which has been obtained through the issuance of Provincial Bonds; second, by the direct issue of the bonds of the Hydro-Electric Power Commission of Ontario, which bonds are guaranteed by the Province of Ontario; third, small amounts of money by bank loans for temporary use. The entire financing of the Hydro-Electric Power

Commission is thus carried out by issuing governmental securities. The securities guaranteed by the Province of Ontario carry a lower rate of interest than securities sold by private companies located within the Province.

The cost of money to the Hydro-Electric Power Commission is not necessarily a fair return upon the physical assets of its properties. For the Ontario Power Company, for instance, the liabilities in the form of the bonds of the Commission and those of the Power Company assumed by the Commission are balanced against plant, transmission lines, franchises, water rights, bond discount capitalized, good-will, etc. As has been brought out in Section D, these intangible assets are held at a value of about \$10,000,000 according to Mr. Clarkson, the Auditor of the Commission's accounts, out of a total value in fixed assets of about \$29,000,000. Likewise the balance sheets for the Thoro'd and Central Ontario Systems show assets in the form of intangibles such as franchises, good-will and contracts.

Between 1911 and 1921 the cost of money to the Hydro-Electric Power Commission has varied between 4% and 6.5%, with a weighted average for all moneys, spent up to October 31, 1920, of over 5%. Under money market conditions of 1920-1921 the cost of money to the Hydro-Electric Power Commission has been about 6.5%. This method of finance eliminates any equity in the property, and the bondholders must receive their protection through the general credit of the Province of Ontario.

The cost of money for electric utilities in California is determined by the Railroad Commission upon the basis of a fair return on the actual property used in the service of the public. No return is allowed on intangibles, such as franchises, water rights, good-will, contracts, etc., but credit is given for the actual cash paid for such rights. The Railroad Commission, through appraisals made on the historic basis, determines the value of the property used.

The actual process of financing electric utilities in California is the method commonly employed in the States, that of stock and bond issues, and the return upon each of these classes of securities depends, to a certain extent, upon the efficiency in financing and managing the properties.

The Railroad Commission defines a fair return upon such investment as one which will induce the flow of capital into an essential and wisely managed industry in the amounts necessary for the development of the State.

Only taxes on lands are charged as cost against the properties of the Hydro-Electric Power Commission, for the reason that all other taxable forms of property owned by it are by law exempt from taxation. Land constitutes but a small portion of the total value of the investments of the Hydro-Electric Power Commission and municipalities, and accordingly the taxes paid are but a small part of those which would have been paid were these properties operated by private companies. The loss of such taxes must be met by the transfer of Provincial

and Municipal taxes from the electric utilities to the general taxpayer, whether he is a consumer of Hydro or not, thus making the general taxpayer contribute to the cost of electric utility operation to at least this extent.

Privately operated companies in the Province of Ontario are all required to pay taxes amounting to about 7.1% of their gross revenues. Likewise in California, electric utilities pay their share of all taxes, which are a considerable item of the cost, the tax in California being over 7.5% of the gross earnings of these companies.

The rates charged to the Municipal Commissions by the Hydro-Electric Power Commission in Ontario must, by law, be upon a cost basis, regardless as to whether such costs when allocated to the several municipal commissions become relatively excessive.

In California, however, a utility is not allowed to collect all cost from the consumers unless this may be done under reasonable rates for service. By one decision an important California company, the California Oregon Power Company, was compelled to go through a reorganization, and to wipe out a large portion of its investment for the reason that a fair return on an admittedly honest investment made for service to the public would make necessary excessive rates unfair to the communities served. The loss in this instance was not experienced by the consumers, as would be the case under the law of Ontario, but by the stockholders of the private company.

The difference between the rate-making methods employed by the Hydro-Electric Power Commission and the Railroad Commission of California is most marked in their application of the determination of what the cost shall be to each of the different municipalities or consumers served. In Ontario the law states that each municipality contracting with the Hydro-Electric Power Commission shall stand its proportionate share of the capital investment and of the annual cost. The Hydro-Electric Power Commission, in determining what these proportions shall be, have endeavored to set up an exact mathematical computation in arriving at the resulting rate or cost.

The difference between the results obtained in Ontario and California is best illustrated by reference to Plate No. 2 on which is shown a hypothetical utility system, having a power station "X" with a transmission system to which are connected five sub-stations: namely A to E, inclusive. The lengths of transmission line assumed are given on the plate, and the various other characteristics of this hypothetical system are assumed to be as follows:

The power plant delivers power to the high tension lines at \$16.00 per horsepower-year.

Transmission lines are considered to have a unit cost of \$10,000 per mile with a total annual cost of \$1,500 per mile.

Sub-stations serving Municipalities A, B, D and E are assumed to have a capacity of 10,000 horsepower each, and to have an annual cost of \$18,000

each, while the sub-station serving Municipality C is assumed to have a capacity of 5,000 horsepower with an annual cost of \$14,000.

Municipalities A, B, D and E are assumed to have each contracted for 10,000 horsepower and to have a demand of equal amount. Municipality C is assumed to have contracted for 10,000 horsepower, but to have a demand of only 4,000 horsepower.

The method used by the Ontario Hydro-Electric Power Commission for determining the annual cost of power to each of these municipalities is as follows:

to it for about \$21.10 per horsepower-year, showing a saving of \$1.64 per horsepower-year over the rate resulting from the line locations shown.

There are a number of such instances on the Niagara System, one being that of Drayton, which could have been reached from Elmira by a line of about 15 miles in length rather than by the selected route through Stratford, Milverton, Listowell and Palmerstown. (See Plate 3). The rate enjoyed by any municipality is thus, to a degree, dependent upon the route for the transmission lines selected by the Commission's engineers.

TABLE NO. 18

Determination for Wholesale Rates to Municipalities using Method Employed by the Hydro-Electric Power Commission for the Hypothetical System given in Plate 2.

	Municipality				
	A	B	C	D	E
Horsepower contracted for.....	10,000	10,000	10,000	10,000	10,000
Horsepower purchased.....	10,000	10,000	4,000	10,000	10,000
Horsepower minimum charge.....	—	—	7,500	—	—
Annual operating costs:					
(1) At power plant X.....	\$160,000	\$160,000	\$120,000	\$160,000	\$160,000
(2) For Line X-A.....	7,900	7,900	5,900	7,900	7,900
(3) " " A-B.....	—	4,000	3,000	4,000	4,000
(4) " " B-C.....	—	—	22,500	—	—
(5) " " B-D.....	—	—	—	22,500	—
(6) " " B-E.....	—	—	—	—	37,500
(7) Sub-stations.....	18,000	18,000	14,000	18,000	18,000
(8) Total Annual Cost.....	\$185,900	\$189,900	\$165,400	\$212,400	\$227,400
Cost per horsepower-year purchased.....	\$18.59	\$18.99	\$43.85	\$21.24	\$22.74
Ratio Maximum to Minimum Rates 2.36 to 1.					

Cost at E were it served by line X-E rather than as indicated:

Cost of Power at Plant.....	\$160,000
Annual Cost Line X-E.....	33,000
Sub-station.....	18,000
Total Annual cost.....	\$211,000
Cost per Horsepower-year.....	\$21.10

The foregoing method results in a wide range in the wholesale rates to the municipalities, the range actually being much greater than here illustrated, and as a matter of fact, for the Niagara System, was about 8.6 to 1 for the year 1920. This method of rate-making is also affected by every addition made to the system, so from year to year a municipality is uncertain as to the rate it will enjoy.

The cost of power to the municipalities as determined by the rate-making system employed by the Hydro-Electric Power Commission of Ontario is largely affected by their location in respect to the source of power, and to the route of the transmission lines over which power is delivered to them. For instance, a municipality such as D, located 50 miles from the source of power, pays more by over 10% for its power than does Municipality A, 25 miles from the power source. On the other hand, comparing Municipalities A and E, both located about the same distance from the power source, the cost to Municipality E is \$4.15 per horsepower-year greater than that for Municipality A, due to the indirect route of the transmission lines, serving Municipality E. Had, on the other hand, a direct line between the power plant X and the Municipality E been constructed, power could have been delivered

There is a third condition of the method of rate-making employed by the Hydro-Electric Power Commission which frequently results in high rates to certain municipalities. A Municipal Commission, in entering into an agreement with the Hydro-Electric Power Commission, contracts for a definite quantity of power and agrees to pay, as a minimum charge, for at least 75% of the amount contracted for. The Hydro-Electric Power Commission maintains a Municipal Engineering Department which aids the municipalities desiring power in determining what the contracted amount should be, and there are a number of instances in which the amounts of power contracted for have been in excess of the business later developed. Municipality C, of the hypothetical system, is an illustration of this. This municipality, located so that it should receive exactly the same rate as Municipality D, is assumed to have contracted for 10,000 horsepower but to be taking but 4,000 horsepower with the result that it would have to pay a rate of about \$43.85 per horsepower-year rather than \$21.24 per horsepower-year paid by Municipality D.

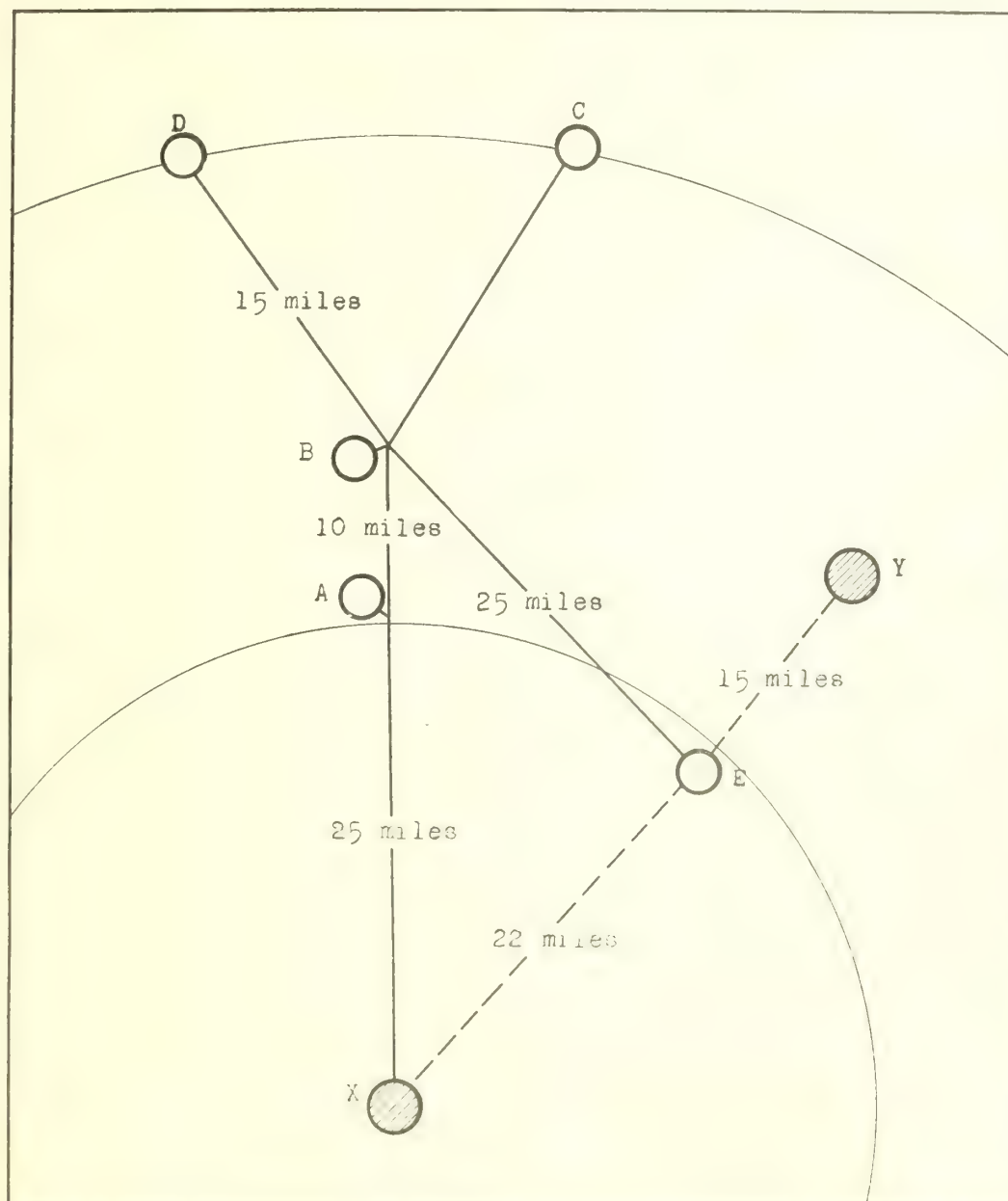
The hypothetical power system has but one power plant constructed, and that is X. If a second plant should be constructed at location Y, the entire

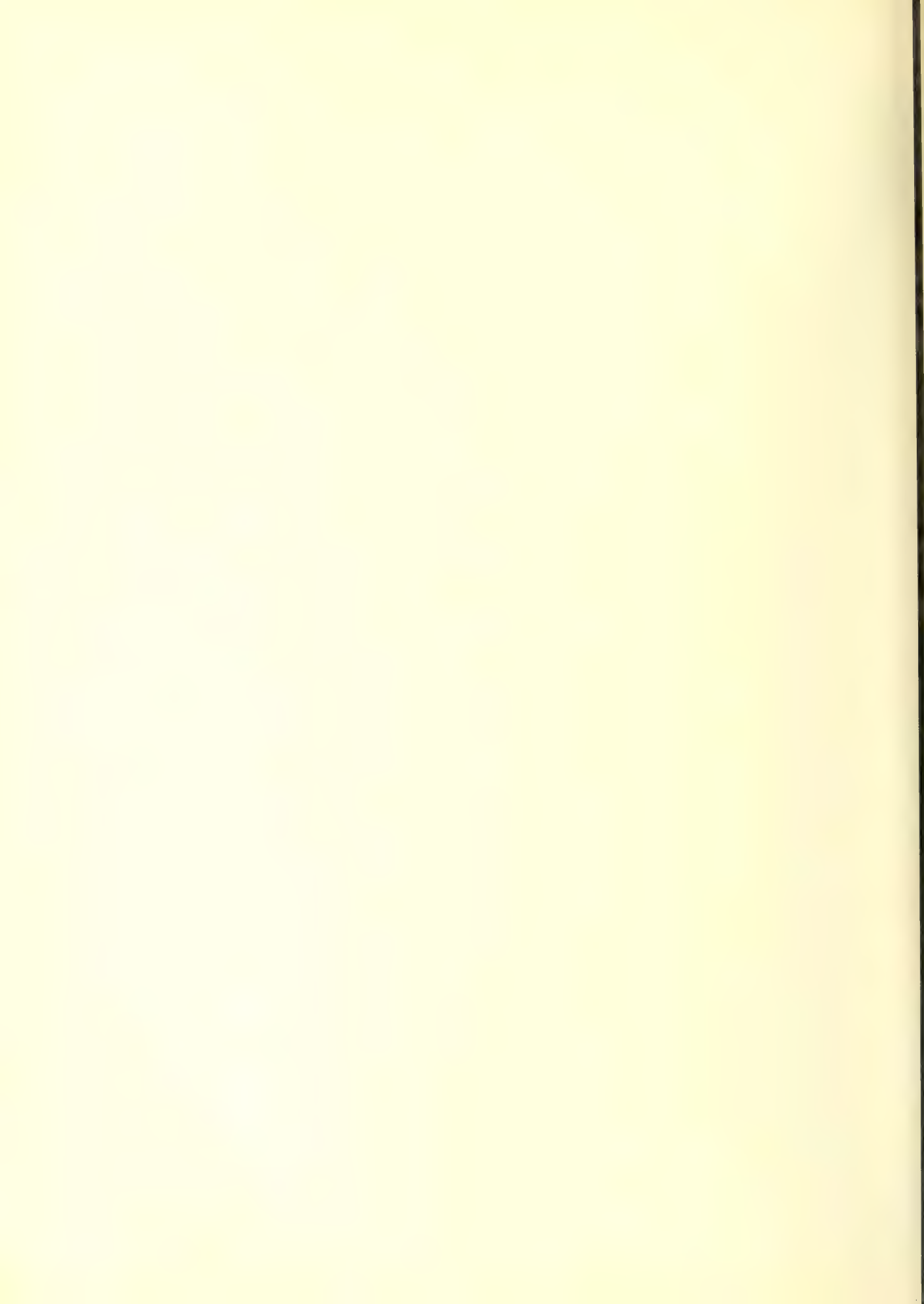
Plate 2

Hypothetical Electric Utility System for demonstration of rate making methods employed by the Hydro Electric Power Commission and the California Railroad Commission.

Legend

- Power Stations
- Municipal or Consumer Substations
- Transmission Lines
- Zone Lines (25 miles)





relation of rates between the municipalities would be changed, and it would seem almost impossible to assign to each municipality and transmission line section a correct proportion of the horsepower output taken from each plant, and under such a condition this rate-making method may become one where the proportionate costs must be more or less arbitrarily assigned.

The rate-making method employed by the Hydro-Electric Power Commission of Ontario favors those municipalities located near the sources of power and in close proximity to the main transmission lines. The lower rates for power to such municipalities cannot avoid the eventual concentration of industry in a few of these favorably located municipalities, and this rate system must, by its very structure, tend to retard industrial development over the Province as a whole.

The Railroad Commission of California makes its rates upon the basis that a municipality should receive its power without respect to the location of the source of power and should receive it at the high tension terminals of its sub-station at the average cost for the entire system. No attempt is made to earmark the actual distribution of the output of each plant to each of the several municipalities. For the hypothetical utility system shown in Plate 2 the average production and transmission cost at the high tension terminals of all sub-stations is \$19.10 per horsepower year, making the cost of power delivered to Municipalities A, B, D and E \$20.90 per horsepower-year, while that for Municipality C, taking a smaller amount of power is \$22.60 per horsepower-year. This gives a ratio between maximum rate and minimum rate of 1.09 to 1 compared to 2.36 to 1 for the method used by the Hydro-Electric Power Commission of Ontario.

The rate system employed by the California Railroad Commission more nearly averages the cost of power to the entire population served than does that system used by the Hydro-Electric Power Commission. The California system is not so greatly affected by the addition of new municipalities or consumers, nor is the individual consumer so severely penalized, should his actual load be less than the original estimates of the load which he could take. The result of applying the rate-making method used by the California Commission leaves no tendency for industry to concentrate at a few locations because of cheap power rates, and accordingly, industry can as profitably locate, so far as power is concerned, at one point on a system as at another.

The greatest difference in the cost arising by the methods used by the two above named Commissions is in the rates to rural customers. Under the Ontario method the cost per unit taken by a rural customer must, of necessity, be exceedingly high, and again must differ widely in the several parts of the Province, making the cost of power prohibitive to such farmers who are unfortunate enough to be located a long distance from the source of power

or trunk line transmissions. The method used in determining rates to the rural customers in the State of California results in a uniform rate to them, which, while higher than that for large urban municipalities does not bear a large ratio to the cost of power to the municipalities, as is the case in Ontario.

Up to the present time but very little rural business has been taken on by the Hydro-Electric Power Commission, and as a result of the high rates for power which the Commission was obliged to charge under the law, a Committee of the Legislative Assembly of Ontario was appointed to report on "A More Equitable System of Distribution of Hydro-Electric Power and a More Uniform Price." This Committee made its report on the 30th of November, 1920, and part of the findings of the Committee are quoted below:

"Your Committee has come to the conclusion that a flat rate for the Province is neither practicable nor advisable, but is convinced that much can be done to lessen the burden of providing small urban centres and the rural districts with Hydro-Electric service.

"The amount of power being used by the Hydro-Electric Power Commission on the various systems in the Province is 337,170 horsepower, and of this only 2,500 horsepower or less than 1% is supplied to the agricultural industry.

"... Unfortunately, under the conditions of service at cost, the price of electricity is prohibitive for agriculture in general."

The Committee recommended that the Province charge a rental upon all water power developed within the Province, whether by private interests or by the Hydro-Electric Power Commission, and that where the cost of power supplied to any municipality or power zone is in excess of \$30.00 per horsepower-year, and the distributing system is owned and operated by the Municipality, or Local Commission, or supplied by the Hydro-Electric Power Commission of Ontario, that the Province should pay out of its revenues to the Municipal Commission a sum equal to 50% of the additional cost in excess of \$30.00 per horsepower-year, limiting, however, the maximum amount of the assistance by the Province, to \$25.00 per horsepower-year, and the Commission further recommended that where power was supplied to the agricultural industries that the Province should give further assistance by granting the Local Commission of the municipality or power zone, a sum sufficient to meet 80% of the annual charge necessary to pay for the cost of building and maintaining in rural districts low tension transmission lines that are necessary for rural distribution, limiting such assistance to 50% of the revenue derived from the power rentals.

As a result of this recommendation the Provincial Legislature passed the following Act:

1. "This Act may be cited as The Rural Hydro-Electric Distribution Act, 1921.
2. There shall be established a fund to be known as the Hydro-Electric Power Extension Fund, hereinafter called the Fund, and the Treasurer of Ontario shall open in the books of the Province an account to be known as The Hydro-Electric Power Extension Fund Account.
3. There shall be placed to the credit of the said fund in such account annually at such time as the Lieutenant-Governor in Council may direct:—
 - (a) A sum equivalent to the total amount falling due to the Province from the rentals of water powers since the 1st day of January 1918, but not including rentals falling due under agreements entered into by the Commissioners of the Queen Victoria Niagara Falls Park for the development of power within the park;
 - (b) A sum equivalent to the revenue derived from the rentals payable or collectable under the several agreements between the Commissioners of the Queen Victoria Niagara Falls Park and certain companies developing power in the Queen Victoria Niagara Falls Park after deducting any sums required to meet the charges and payments referred to in sections 21 and 23 of The Queen Victoria Niagara Falls Park Act;
 - (c) Such additional sums as may from time to time be voted by the Legislature of the Province of Ontario for the purpose hereinafter mentioned.
4. Where power is supplied to a rural power district under the provisions of The Power Commission Act and amendments thereto there may be paid to the municipality or commission distributing the power in such rural power district upon the recommendation of The Hydro-Electric Power Commission of Ontario and the order of the Lieutenant-Governor in Council, a sum not exceeding fifty per cent of the capital cost of constructing and erecting in the rural power zone primary transmission lines and cables required for the delivery of power in such rural power district.
5. The grant made under this Act shall be payable out of the Consolidated Revenue Fund, and the sums required to be credited to the Fund shall be chargeable to the Consolidated Revenue Fund, and every grant of money made under this Act shall be debited to the Fund in the said account and the said account shall be so kept that at all times it shall show the amounts properly credited to the Fund as provided by section 3 and all amounts chargeable thereto.
6. The Lieutenant-Governor in Council may make regulations for the better carrying out of the provisions of this Act.

7. This Act shall come into force on the 1st day of June, 1921."

As far as service to rural communities and customers is concerned, service at cost is now a principle of the past, and the general taxpayer of the Province is, by taxation, helping the farmer to pay for the cost of his power.

Wholesale Cost for Power to the Municipalities Resulting from the Rate-making Methods of the Hydro-Electric Power Commission of Ontario

On Plate No. 3 is shown the interim wholesale rate quoted to each municipality, for the Niagara, Eugenia and Severn Systems for the year 1920. The transmission lines serving the Niagara District are indicated on this plate by the gold lines, those for the Eugenia System by red lines, and those for the Severn System by green lines. The interim wholesale rate is given within the circle designating the location of the municipalities served, while the actual rate paid by the municipalities is shown in brackets underneath the municipalities named.

For the Niagara System, the lowest interim wholesale rate quoted is for Niagara Falls of \$11.50 per horsepower-year, while the highest rates quoted are those for Watford and Princeton of \$85.00 per horsepower-year. The actual wholesale rates for this system vary between \$12.40 per horsepower-year paid by Niagara Falls and \$91.00 per horsepower-year paid by Princeton.

For the Eugenia System, the interim wholesale rates vary between \$28.00 per horsepower-year for Owen Sound and \$85.00 per horsepower-year for Tara, while the actual wholesale rate paid varies between a minimum of \$36.90 for Markdale and \$156.50 for Holstein.

For the Severn System, the wholesale interim rate varies between \$28.00 per horsepower-year for Midland to \$85.00 per horsepower-year for Port McNicoll, Thornton, Beeton and Tottenham, while the actual wholesale rate paid by the municipalities varies between \$26.00 per horsepower-year for Midland and \$124.00 per horsepower-year for Tottenham.

The entire Eugenia and Severn Systems are located within the maximum length of the transmission line between Niagara Falls and Windsor for the Niagara System, so that had the Hydro-Electric Power Commission extended its lines northerly rather than in a westerly direction from Niagara Falls, the municipalities of these two systems would have been closer to Niagara Falls than Windsor and the other municipalities at the western end of the Niagara System. The comparison of rates, therefore, between any of the given municipalities is fair from the standpoint of being within comparable distances of Niagara Falls. Thus, for the combination of the three systems, the wholesale price of power to the municipalities varies from a minimum of \$12.40 per horsepower-year to a maximum of

\$156.00 per horsepower-year, a range of approximately 12.5 to 1.0.

There are several cases that may be noted from Plate No. 3 of the effect of the location of transmission lines upon the cost of power to the municipalities served. For instance, Glencoe was paying \$59.50 per horsepower-year in 1920. Power is brought to Glencoe by means of a line running from Dutton to Ridgetown and Thamesville. At Dutton power is sold for about \$34.00 per horsepower-year and a comparatively short line from Dutton would have been required to reach Glencoe, in fact, one not much longer than that existing between Glencoe and Bothwell. Had Glencoe been served from Dutton rather than as it is, the cost of power to it should be less than what it now pays.

Another illustration of the effect of applying the rate-making method used by the Commission is that obtained in comparing Aylmer and Springfield. Springfield is served through Woodstock, and paid a wholesale rate of \$58.50 per horsepower-year in 1920, while Aylmer, located but a few miles distant, is served from St. Thomas and paid a wholesale rate of \$45.60 per horsepower-year. The extension of a line from Aylmer to Springfield would probably have resulted in Springfield receiving its power at a lower cost than it now enjoys.

Even more marked than the differences in the wholesale prices paid by municipalities on one system, by reason of their location, is the difference in the prices paid by municipalities located but short distances apart, and served by separate systems. For instance, Harriston, on the Niagara System, pays a wholesale rate of \$42.00 per horsepower-year as compared to Mt. Forest on the Eugenia System, which pays \$67.00 per horsepower-year. Mt. Forest, if fed from Harriston, would require a shorter line than that from Durham, over which it receives service, and had Mt. Forest received its power from the Niagara System, rather than the Eugenia System, the rate it would pay for power should be lower than it is under the existing conditions.

Likewise, Grand Valley, on the Eugenia System, pays a wholesale rate of \$76.20 per horsepower-year compared to Fergus, on the Niagara System, which pays \$39.00 per horsepower-year. A line extension between Fergus and Grand Valley would have been no longer than that between Shelburne and Grand Valley, and would have resulted in a reduction in the cost of power to Grand Valley, had it been served in this manner.

In comparing the wholesale cost for power of other systems to that of Niagara, the higher production costs for these other systems must be borne in mind.

A further study of Plate No. 3 will bring out that those municipalities located east of Waterloo and Brantford generally paid an actual wholesale rate higher than the interim wholesale rate, and the municipalities west of these locations received wholesale rates less than the interim wholesale rates quoted for 1920.

With the wholesale rate-making method used by

the Hydro-Electric Power Commission, the location of a municipality with reference to the source of power is a considerable element in the cost which the municipality has to pay for power.

On Plate No. 4 the Niagara Peninsula is divided into several zones of 50 miles in width. The centre about which these zones are taken is Niagara Falls, but the distance is the land air line distance rather than a direct air line distance, owing to the impossibility of taking transmission lines directly across Lake Ontario.

For each of the zones shown, the weighted average wholesale cost of power for each system has been computed and these costs are shown on the plate by the height of the columns.

For the Niagara System, it will be noted that the cost of power is the lowest in the first zone from the source of power and that it gradually increases, becoming a maximum in the zone most distant from the power source.

The Eugenia System lies principally within the second and third zones from Niagara Falls, and had the transmission system from Niagara Falls been extended into this territory, rather than to the west, these municipalities instead of paying from two to over three times as much as municipalities on the Niagara System, would have received wholesale power costs comparable to those now being paid on the Niagara System.

Likewise, the Severn System lies in the second and third zones from Niagara Falls, and the Wasdell System lies practically entirely within the third zone. Both of these systems pay higher wholesale rates than do the municipalities on the Niagara System within the same zones.

For the Niagara System in Zone 1, the actual wholesale rate paid was about 8% greater than the interim wholesale rate quoted, for Zone 2 the increase in the actual wholesale rate over the interim wholesale rate was of about the same percentage, while for Zone 3 the actual wholesale rates and interim wholesale rates were in close correspondence. However, in Zone 4 the actual wholesale rate paid dropped 16% below the interim wholesale rate quoted, and for the last zone dropped to about 13% below the interim wholesale rate. In other words, when adjustments were made at the end of the year, it was found that the interim wholesale rates had been under-estimated for the first two zones, and over-estimated for the last two.

From the financial standpoint, the law requires each system to be operated independently of the other, but provision is made for allowing physical interconnection, and the sale of power from one system to another at prices to be determined by the Hydro-Electric Power Commission. Plate No. 4 shows that under these conditions, the people living in the districts served by the systems other than the Niagara, even though they are within equal distance of Niagara Falls, must pay higher wholesale rates for power because of the location of the arbitrary boundaries of the several systems.

In working up the material for this analysis, the

Niagara Peninsula was divided into 25-mile zones, and in that zone lying between 125 to 150 miles from Niagara Falls, the population served by the several systems was; 17,333 for Niagara, 21,857 for Severn and 15,182 for Eugenia. Thus, the populations are no far different for any of the systems and it might well be assumed that an equal amount of business would result by the extension of the lines into any of these three localities. However, reference to Figure No. 19 showing the distribution of the average horsepower purchased in 1920 for each zone from the Hydro-Electric Power Commission, brings out that the municipalities of the Niagara System take nearly twice as much power as do those of the Severn System, in the third zone, and nearly three times as much power as do those of the Eugenia System, in the same zone, and by again referring to Plate No. 4, the reason is at once evident for the cost of power in this zone for the Severn System is about 46% in excess of that for the Niagara System, and for the Eugenia System is about 84% in excess of that for the Niagara System. For the same zone, the difference in the power taken between the Wasdell System and the Niagara System is even more marked, but this is due, to a certain extent, to the fact that the Wasdell System serves a more sparsely populated section. The Wasdell's System in Zone 3 purchases but 17% of the power taken by the Niagara System in that zone, but it pays a unit price greater by 150%.

The actual application of the wholesale rate-making methods employed by the Hydro-Electric Power Commission of Ontario thus results in widely varying wholesale costs for power to the municipalities, placing at a disadvantage those municipalities which are not favorably located in respect to taking power from the Niagara System, or of not being located near the source of power or the main lines of that system. This variation in the cost of power deals only with wholesale rates to the municipalities, and an even wider variation is found when the rates for power, sold directly by the Hydro-Electric Power Commission to individual companies, is included.

The retail rates paid by the consumers in the several municipalities, which are higher than the wholesale rates, are, of course, affected by these wide variations in the wholesale rates, so that the people of Ontario receiving Hydro-Electric Service are paying domestic retail rates varying from as low as 2.5 cents per kw.-hr. to as high as 12.9 cents per kw.-hr., and are also paying retail power rates varying over an equally wide range.

The Relation of Wholesale Interim Rates to the Actual Rates Paid by the Municipal Commission of the Hydro-Electric Power System

The Hydro-Electric Power Commission of Ontario estimates what the wholesale cost of power to each Municipal Commission will be, and upon the basis of those estimates, it names the interim rate, at which rate the Municipal Commission is charged for power for the twelve ensuing months.

These rates are based not only upon the estimated cost of power, but upon the demand for power which each Municipal Commission will make against the Hydro-Electric Power Commission.

Upon the termination of the year's business, the actual cost of power to each municipality is computed in the manner previously described and a thirteenth bill is rendered to the Municipal Commission showing either a charge or a credit, depending upon whether the cost of power, as actually computed, has been greater or less than the interim rate which the Municipal Commission paid for power during the year in question.

In the 1920 Annual Report of the Commission, the interim rates for 169 municipalities are given, while the actual rate paid can be computed for 174 municipalities. The highest interim rates that were quoted in this report were between \$80.00 and \$90.00 per horsepower-year, while the highest actual rate paid per horsepower-year was between \$150.00 and \$160.00. Altogether there were nine municipalities which paid a rate higher than the maximum interim rate quoted.

Three systems show municipalities having rates of less than \$20.00 per horsepower year. These are the Niagara System, with eight municipalities, the Muskoka System, with one municipality, and the Thunder Bay System, with one municipality.

The statement is commonly made that the Hydro-Electric Power Commission is delivering practically all of its power at less than \$20.00 per horsepower per year, but it will be seen from Table No. 19, following, that such is not at all in accord with facts, and this is further illustrated by Figure No. 20.

The actual weighted average (wholesale) rate paid varied from a minimum of \$19.00 per horsepower-year for the Thunder Bay System, to as high as \$69.80 per horsepower-year for the Wasdells System. The large bulk of power which is delivered from the Niagara System is sold at an average wholesale rate of \$21.00 per horsepower-year. The Thunder Bay System having the lowest cost given was not as yet receiving power from the Nipigon Development, as the power during 1920 was still being furnished by the Kaministiquia Power Company.

Retail Rates Charged to Customers by the Municipal Commissions in Province of Ontario

The retail rates charged by the municipalities to their customers are divided into four distinct classes, namely:

- (a) Rates for domestic lighting;
- (b) Rates for commercial lighting;
- (c) Rates for industrial power;
- (d) Rates for municipal street lighting.

The rates for domestic lighting, as formulated by the Hydro-Electric Power Commission, in force in the municipalities, are based on a service charge of a definite amount per square foot of floor area, plus a charge for each kw.-hr. purchased. This form of rate results in widely different net costs per kw.-hr.

PLATE 3

DATA FROM COMMISSION'S PUBLISHED REPORT FOR 1920
MURRAY & FLOOD, NEW YORK, N.Y.

NOTE A A 13TH CHARGE (OR CREDIT) IS MADE AT THE END OF THE YEAR
 " B IF A MUNICIPALITY USES LESS THAN 75% OF THE POWER CONTRACTED FOR, ITS RATE IS INCREASED
 " C ACTUAL FINAL CHARGES ARE SHOWN IN PARENTHESES

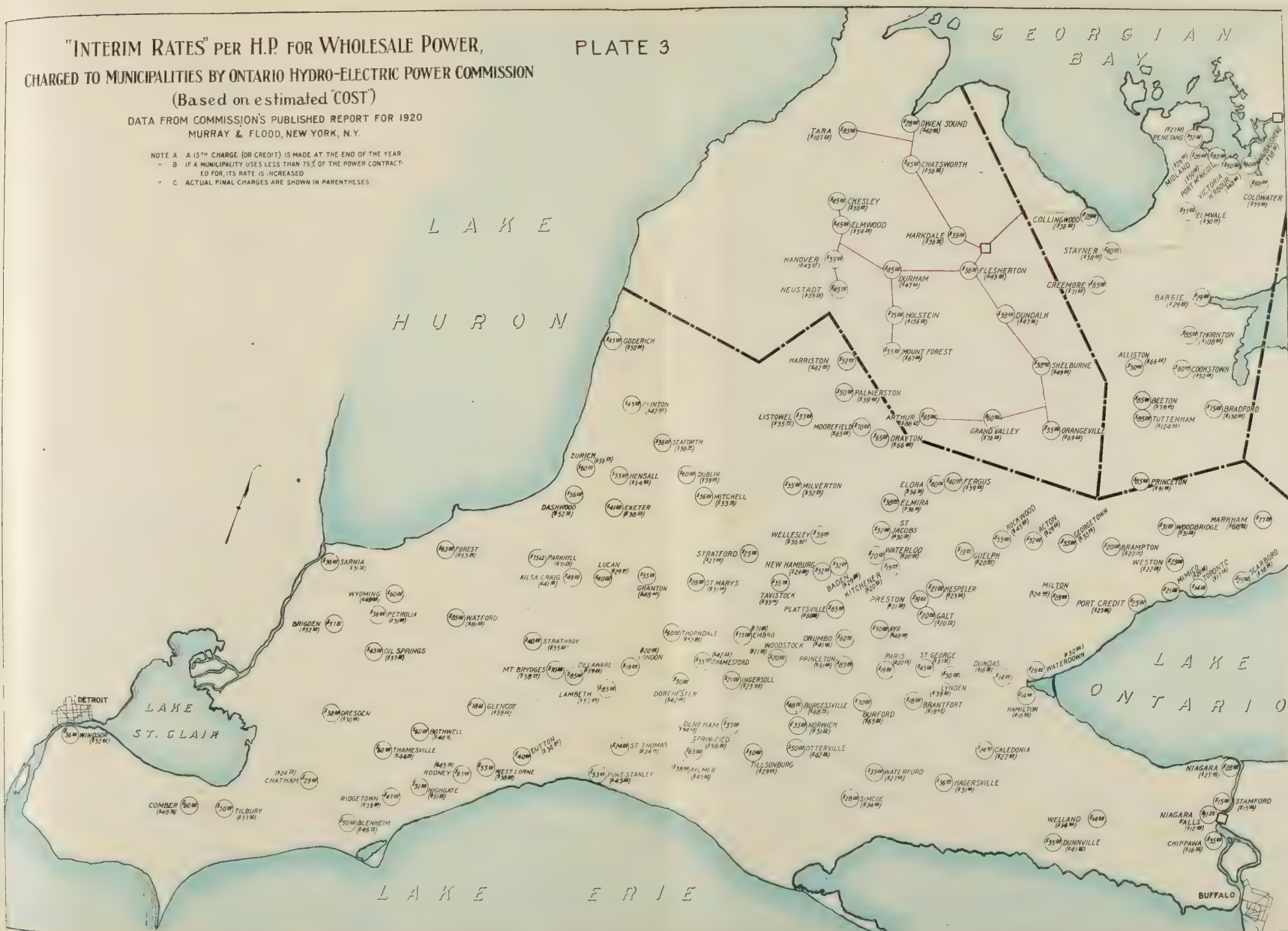




PLATE NUMBER 4

WHOLESALE COST OF POWER IN 1920
TO THE MUNICIPALITIES
IN THE NIAGARA PENINSULA OF ONTARIO

MURRAY AND FLOOD
NEW YORK
Nov 7 1921

LEGEND BLOCK HEIGHT DENOTES WEIGHTED AVERAGE
WHOLESALE COST OF POWER TO MUNICIPALITIES
SCALE 1 INCH = \$20 PER H.P. PER ANNUM

OF NIAGARA SYSTEM

OF SEVERN SYSTEM

OF EUGENA SYSTEM

OF WASSELL SYSTEM

OF MURKOKA SYSTEM

SYSTEM BOUNDARIES

ZONE BOUNDARIES DETERMINED BY AIR LINE (LAND)
DISTANCE FROM NIAGARA FALLS

NOTE - THE ACTUAL WEIGHTED AVERAGE WHOLESALE COST
FOR EACH ZONE AND SYSTEM WAS DERIVED FROM
VOL. I, 1920 ANNUAL REPORT OF THE HYDRO ELECTRIC
POWER COMMISSION OF ONTARIO

THIS REPORT SUPPLEMENTED BY REPORT ANNUAL

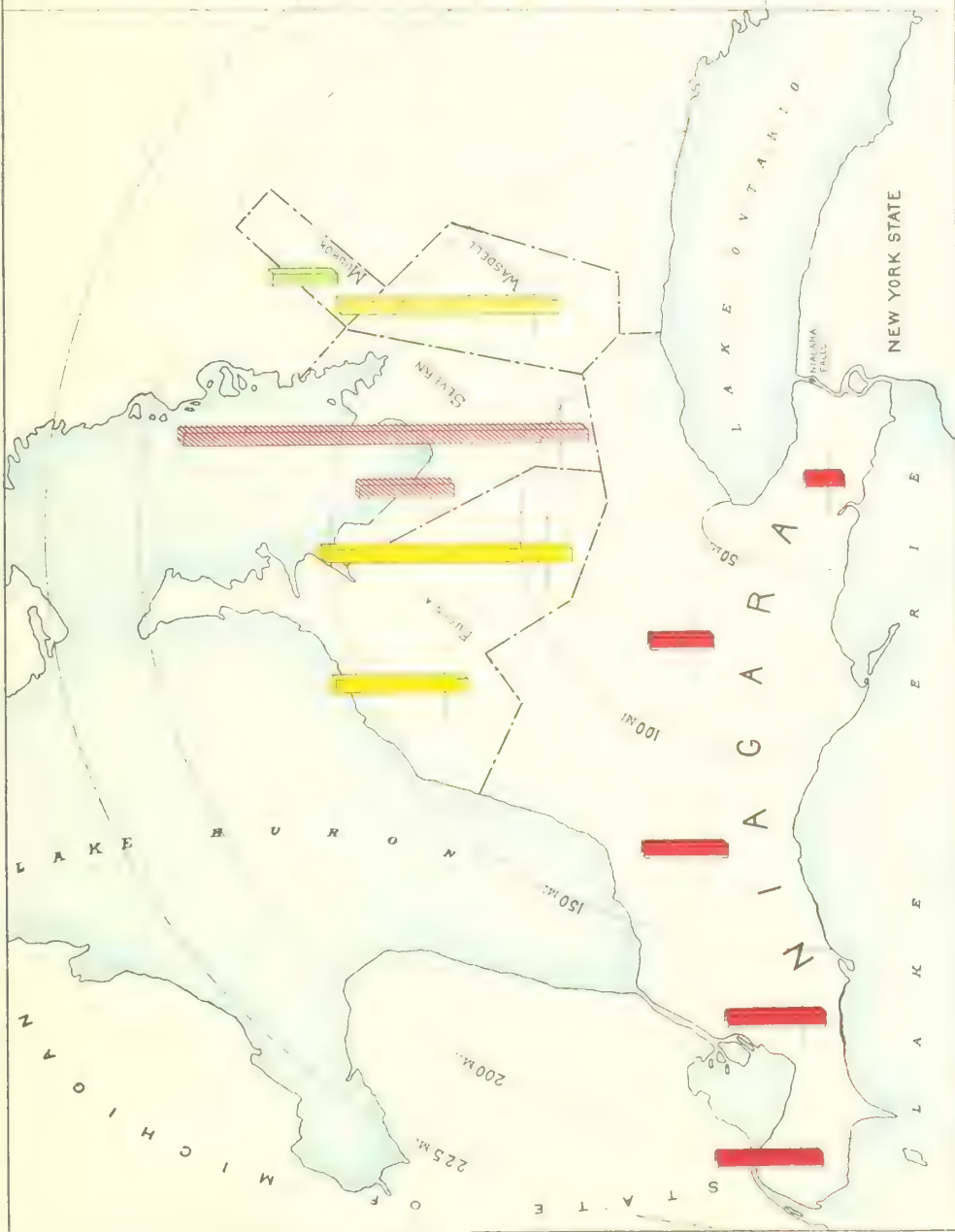
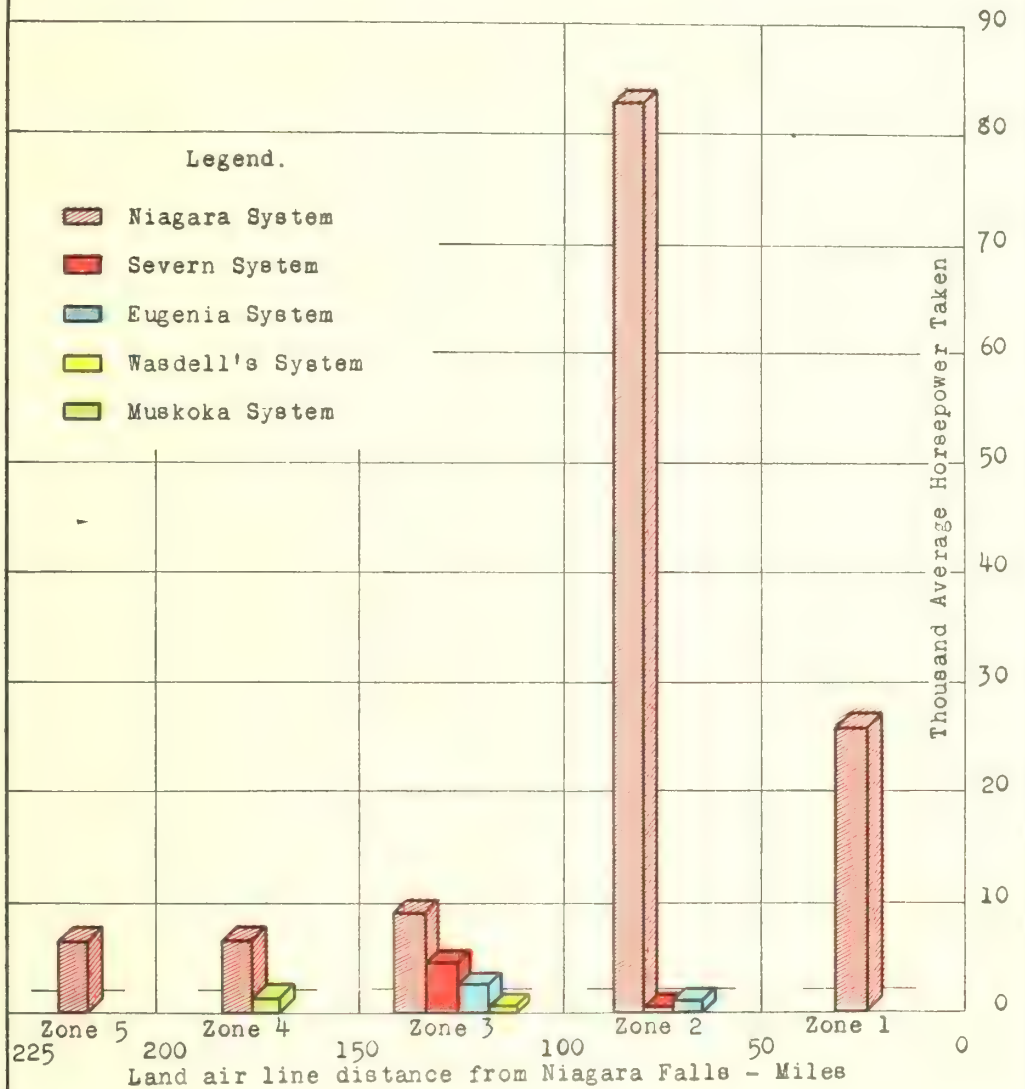




Figure 19

Totals of the Average Horsepower taken
in 1920 by the Municipalities for
each Zone segregated into Systems.



MURRAY AND FLOOD REPORT

to the customer for the energy used. There is also a minimum monthly bill varying from 50 cents per month to \$1.50 per month.

The commercial rates are based on energy rates per kw.-hr. varying with the number of hours of use of the maximum demand. This class of rate also varies over a wide range, the net cost per kw.-hr. to the customer.

The rules and regulations of the Hydro-Electric Power Commission state that the installed capacity of the commercial service will be taken as the total rated capacity of lamps, or of the single phase motors and appliances connected, whichever is the greater.

These rules further state that the minimum charge for commercial service shall amount to at least five cents per month for each 100 watts installed capacity, but in no case shall the monthly net bill be less than 50 cents.

Industrial power rates charged by the municipalities are based upon a fixed amount for each horsepower of demand plus an energy rate, varying in amount with the number of hours of use of the maximum demand. These power bills are subject to discounts for prompt payment varying from about 10% to over 50%, depending on the location of the municipality in respect to the source of power.

TABLE NO. 19

WHOLESALE INTERIM AND ACTUAL RATES TO THE MUNICIPAL COMMISSIONS FOR THE SEVERAL SYSTEMS OF THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO FOR THE YEAR 1920

	SYSTEM					
	Niagara		Severn		Wasdells	
	Estimated Interim rate	Actual Rate Paid	Estimated interim rate	Actual Rate Paid	Estimated interim rate	Actual Rate Paid
Number of Municipalities listed in H. E. P. C. 1920 Annual Report.....	(a) 118	121	17	17	6	6
Interim Rates charged and Actual Rates paid for the year 1920 by number of Municipalities						
Less than \$20.00 per hp.-year.....	12	8	—	—	—	—
Bet. \$20.00 and \$30.00 per hp.-year.....	24	32	3	3	—	—
“ 30.00 “ 40.00 per hp.-year.....	33	35	3	5	—	—
“ 40.00 “ 50.00 per hp.-year.....	14	22	4	1	1	—
“ 50.00 “ 60.00 per hp.-year.....	19	14	1	2	1	1
“ 60.00 “ 70.00 per hp.-year.....	8	4	1	1	1	1
“ 70.00 “ 80.00 per hp.-year.....	4	2	1	2	1	3
“ 80.00 “ 90.00 per hp.-year.....	4	1	4	—	2	—
“ 90.00 “ 100.00 per hp.-year.....	—	1	—	—	—	1
“ 100.00 “ 110.00 per hp.-year.....	—	2	—	1	—	—
“ 110.00 “ 120.00 per hp.-year.....	—	—	—	—	—	—
“ 120.00 “ 130.00 per hp.-year.....	—	—	—	2	—	—
“ 130.00 “ 140.00 per hp.-year.....	—	—	—	—	—	—
“ 140.00 “ 150.00 per hp.-year.....	—	—	—	—	—	—
“ 150.00 “ 160.00 per hp.-year.....	—	—	—	—	—	—
Weighted Average Actual Rate—1920, Dollars per hp. year.....	\$21.00		\$34.70		\$69.80	
Horsepower Purchased—1920.....	151,420		4,789		319	

	SYSTEM					
	Engema		Muskoka		Rideau	
	Estimated Interim rate	Actual Rate Paid	Estimated interim rate	Actual Rate Paid	Estimated interim rate	Actual Rate Paid
Number of Municipalities listed in H. E. P. C. 1920 Annual Report.....	(a) 17	18	2	2	(a) 3	4
Interim Rates charged and Actual Rates paid for the year 1920 by number of Municipalities						
Less than \$20.00 per hp.-year.....	—	—	1	1	—	—
Bet. \$20.00 and \$30.00 per hp.-year.....	1	—	1	1	—	—
“ 30.00 “ 40.00 per hp.-year.....	5	2	—	—	1	2
“ 40.00 “ 50.00 per hp.-year.....	5	7	—	—	2	1
“ 50.00 “ 60.00 per hp.-year.....	3	3	—	—	—	—
“ 60.00 “ 70.00 per hp.-year.....	1	2	—	—	—	—
“ 70.00 “ 80.00 per hp.-year.....	1	1	—	—	—	—
“ 80.00 “ 90.00 per hp.-year.....	1	1	—	—	—	—
“ 90.00 “ 100.00 per hp.-year.....	—	—	—	—	—	—
“ 100.00 “ 110.00 per hp.-year.....	—	—	—	—	—	—
“ 110.00 “ 120.00 per hp.-year.....	—	—	—	—	—	—
“ 120.00 “ 130.00 per hp.-year.....	—	—	—	—	—	—
“ 130.00 “ 140.00 per hp.-year.....	—	—	—	—	—	—
“ 140.00 “ 150.00 per hp.-year.....	—	—	—	—	—	—
“ 150.00 “ 160.00 per hp.-year.....	—	1	—	—	—	—
Weighted Average Actual Rate—1920, Dollars per hp. year.....	\$51.12		\$20.20		\$40.00	
Horsepower Purchased—1920.....	3,191		13.50		16.37	

TABLE NO. 19—Continued

WHOLESALE INTERIM AND ACTUAL RATES TO THE MUNICIPAL COMMISSIONS FOR THE SEVERAL SYSTEMS OF THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO FOR THE YEAR 1920

	St. Lawrence		SYSTEM Thunder Bay		All Systems	
	Estimated Interim rate	Actual Rate Paid	Estimated interim rate	Actual Rate Paid	Estimated interim rate (a)	Actual Rate Paid
Number of Municipalities listed in H. E. P. C. 1920 Annual Report	5	5	1	1	169	174
Interim Rates charged and Actual Rates paid for the year 1920 by number of Municipalities						
Less than \$20.00 per hp.-year	—	—	1	1	14	10
Between \$20.00 and \$30.00 per hp.-year	—	—	—	—	29	36
30.00 " 40.00 per hp.-year	—	—	—	—	42	44
40.00 " 50.00 per hp.-year	3	1	—	—	29	32
50.00 " 70.00 per hp.-year	—	2	—	—	24	22
70.00 " 80.00 per hp.-year	1	—	—	—	12	8
80.00 " 90.00 per hp.-year	1	2	—	—	8	11
90.00 " 100.00 per hp.-year	—	—	—	—	11	2
100.00 " 110.00 per hp.-year	—	—	—	—	—	2
110.00 " 120.00 per hp.-year	—	—	—	—	—	4
" 120.00 " 130.00 per hp.-year	—	—	—	—	—	—
" 130.00 " 140.00 per hp.-year	—	—	—	—	—	2
" 140.00 " 150.00 per hp.-year	—	—	—	—	—	—
" 150.00 " 160.00 per hp.-year	—	—	—	—	—	1
Weighted Average Actual Rate—1920, Dollars per hp.-year	\$56.00		\$19.00		\$23.10	
Horsepower Purchased—1920	14.57		5,468		169,631	

Note: "a" Interim rates not given for all the municipalities listed

Power rates are further sub-divided into different classes in respect to the restrictions placed upon the customer in the use of power. There are five main classes, namely Class A to Class E, varying from 24-hour unrestricted use, on which no discount other than the cash payment discount is applied, to those for Class D for 10-hour restricted use, which obtains 33 1/3% discount. There are also rates for "Summer Power" and for "Short Term Power," to which special rates are applied.

The maximum demand is determined by a maximum demand meter, which the customer purchases himself. Where no maximum demand meter is installed, it is based on the total horsepower connected.

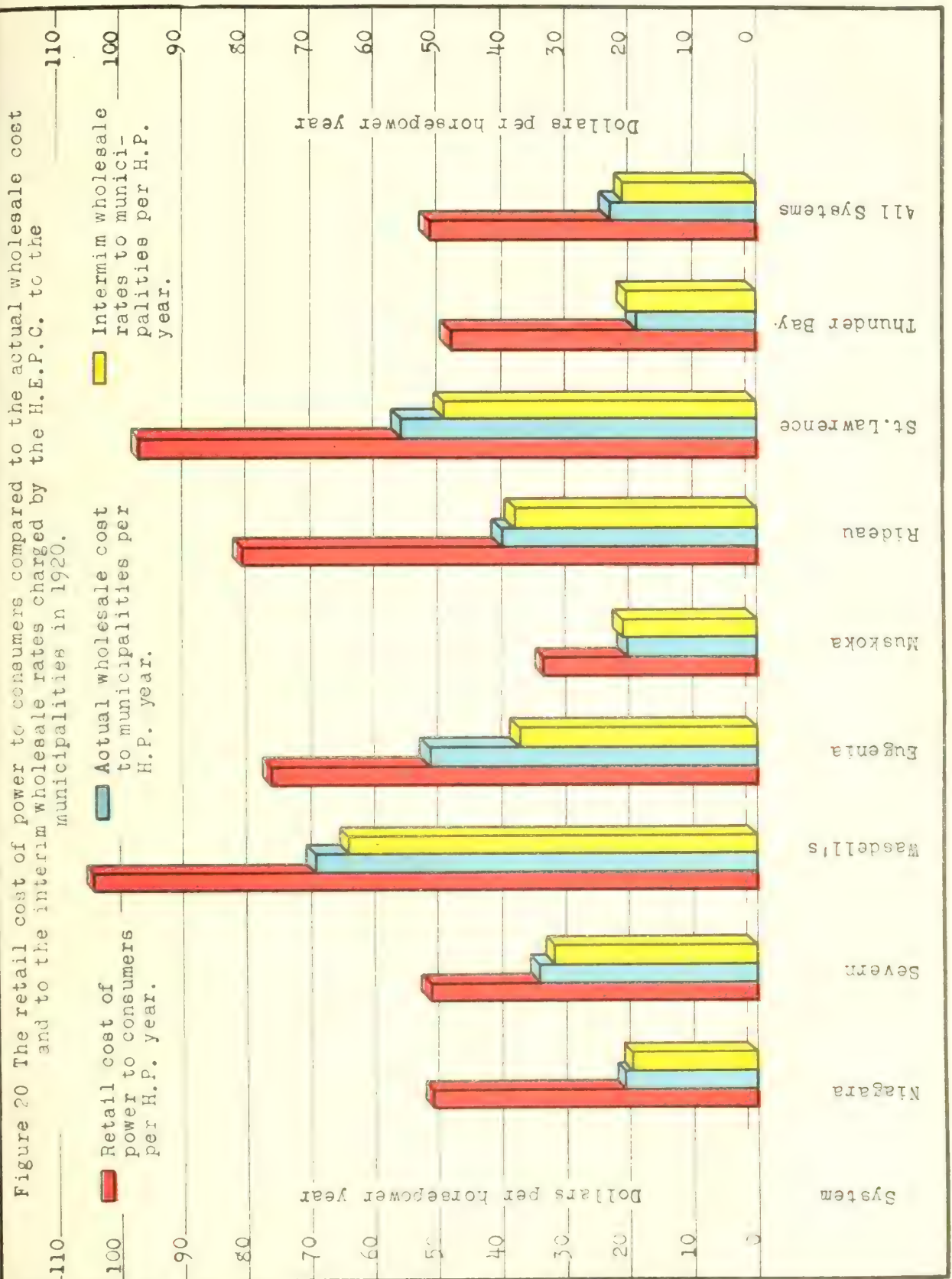
The service charge to the consumer is each month billed on the maximum demand taken during that month, but in case of decreased load, this demand will not be taken to be less than 75% of the highest maximum demand previously established. Where the maximum demand is determined by a graphic recording meter, and the installed capacity is 100 horsepower or less, a sustained peak of one minute duration is sufficient for the basis of the billing; where the installation is over 100 horsepower, one additional minute is allowed for every additional 100 horsepower or part thereof up to and including 500 horsepower, while if the capacity is in excess of 500 horsepower, a five minute sustained peak is used. When an integrating maximum demand meter is installed, the highest average demand for any ten consecutive minutes during the month is taken to be the maximum demand.

The Municipal Commissions purchase their power from the Hydro-Electric Power Commission on the basis of a twenty-minute peak, which is determined by graphic recording maximum demand meters. Retail power is sold with a fixed charge based on a shorter period of peak load than is the case for wholesale power purchased by the Local Commissions from the Hydro-Electric Power Commission of Ontario, and this results in a diversity between the retail power loads and the wholesale power load. Furthermore, as is noted above, the smaller sized installation bearing the same base rate for power pays a higher unit price for energy because of the smaller time element taken for the measurement of the peak load.

In view of the rules and regulations of the Hydro-Electric Power Commission, setting forth how the maximum demand for power installations shall be measured, it is difficult to understand Sir Adam Beck's statement before the Water Power Committee of the House of Representatives in 1918, during which he stated:

"The small user buys electricity at the same price as the large user. There is a standard rate in every community which applies whether you use 10 horsepower or 10,000 horsepower."

If at the end of the municipal fiscal year, which terminates December 31st, the operating costs for the municipal distribution system are shown to be in excess of the revenues obtained by use of the retail rates in force for that year, the Hydro-Electric





Power Commission increases the retail rates to eliminate the deficit during the following year, and per contra, should the difference between the revenue received from the rates in force and the operating cost of the municipal distribution system show a large surplus, the Hydro-Electric Power Commission so alters these retail rates as to reduce this surplus to a reasonable figure for the following year.

Customers of the Municipal Commissions, in the Province of Ontario, are not assured of a fixed rate for the class of service which they are taking for any definite length of time. This is brought out by the following taken from "Standard Interpretations of Rates as Used by Municipalities for Electric Service." (Form 160315):

"Contracts are for one year and are self-renewing from year to year, expiring only when notice is given by either party at least one month prior to the expiration of the yearly term, and subject to the terms of Clause 49.

"All contracts terminate, as far as rates are concerned, upon the order of the Hydro-Electric Power Commission of Ontario, and may be amended from time to time upon the mutual agreement of the Consumer and the Corporation, upon changes being made in the Consumer's equipment or conditions of operation appearing. This will not in any way alter the other terms and conditions of the contract.

"There will be no discrimination as to rates between consumers using electric energy under like conditions.

"There will be no free lamp renewals."

Rates for Companies Contracting Directly with the Hydro-Electric Power Commission

The Hydro-Electric Power Commission, under the Power Commission Act, is empowered to contract directly with industrial companies, particularly where service to such companies is not available from the Municipal Commissions.

Each agreement between a municipality and the Hydro-Electric Power Commission of Ontario contains the following clause:

"Without discrimination in favor of the applicants as to the price to be paid for equal quantities of power, the Commission may supply power upon such terms and conditions as may, having regard to the risk and expense incurred and paid, and to be paid by the Corporation, appear equitable to the Commission and are approved by the Lieutenant Governor in Council.

" . . . and no power shall be supplied within the limits of a municipal corporation taking power from the Commission at the time of such application without the written consent of the corporation."

The Hydro-Electric Power Commission has from time to time contracted with industrial companies

under the terms of the above clauses, and in making such contracts, it has not necessarily followed the rules and regulations laid down for the municipal corporations in making rates to their individual customers. In most instances it has contracted with the company for the sale of power to them at a definite rate for periods of time greater than one year. For instance, in the case of the Nipigon Fibre & Paper Company, specifically mentioned in Section G, the contract has a life of ten years with the rates mentioned therein holding good for the entire life of the contract.

On the Niagara System, at the beginning of the fiscal year of 1921 there were about twenty-five contracts with industrial companies, not including those on rural lines. These contracts have expiration dates varying between May 1, 1921, to February 22, 1937. The forms of rates used are either a demand charge per horsepower-year or a demand charge plus an energy rate. There were, at the beginning of the fiscal year of 1921, about twenty-two additional contracts of this nature on the other systems, excluding the Thorold System and Niagara rural lines.

The relation of these rates made directly to industrial companies by the Hydro-Electric Power Commission to those made by the Commission for wholesale power to the several municipalities is shown in Figure No. 9, Section D.

For the Niagara System, the average wholesale rate to the municipalities was about \$21.00 per horsepower-year, while that to industrial companies contracting directly with the Commission on the Niagara System was \$14.95 per horsepower-year, or about 71% of the rate charged to the municipalities.

For the Wasdell System, the municipalities were charged an average rate of \$69.80 per horsepower-year as against \$29.70 for companies, which is 42½% of that paid by the municipalities.

The average wholesale rate to the municipalities of all the systems served by the Hydro-Electric Power Commission was \$22.60, while the average retail rate to all the companies served directly by the Commission was \$15.95, which is about 70% of the wholesale rates paid by the municipalities.

The municipalities purchasing wholesale power must pay their proportional cost of the total operations, and this, of course, varies from year to year, making it impossible for a municipality to exactly know, in advance, the wholesale rate it will enjoy during the succeeding year. On the other hand, the Commission, by contracting directly with companies for a definite period of time, and at a stated price, assures such companies of a fixed price for power over a period of years, and from the weighted average cost of the wholesale rates earned by the municipalities and those of the companies, the latter appear to be favored with lower costs for power.

In Figure No. 21, the base retail power rates charged in the municipalities of Niagara Falls, Ont., Hamilton, Toronto, London, Windsor and Goderich for the fiscal year of 1920 have been quoted to

low the resulting rate per horsepower year, and per kw.-hr. at annual load factors varying from zero to 75%.

The weighted average rate at which power was sold to the companies on the Niagara System, by the Commission, for the year of 1920 was \$14.95 per horsepower-year, and thus any power customers for that specific year in Toronto having a load factor higher than 5.0%, in Niagara Falls, Ontario having a load factor higher than 47%, in Hamilton having a load factor higher than 20%, in London having a load factor higher than 9%, in Windsor having a load factor higher than 2.5% and in Goderich having a load factor higher than 2% are required to pay higher rates by virtue of the structure of the retail rates charged in these several municipalities.

Likewise at Owen Sound on the Eugenia System, the retail power rate at Owen Sound equals that to companies at 100% load factor, for the Severn System the retail power rate at Midland equals that to companies at 17% load factor, and for the Wasdell System the retail power rate to Beaverton equals that to companies at 5% load factor, while on the St. Lawrence System the retail power rate to Brockville equals that to companies at 8% load factor. In any of these municipalities where the power customers do have a load factor higher than those stated, the base retail power rate to them would be higher than that for power sold directly to the companies by the Commission. The base retail power rates between zero and 75% load factor for the municipalities on systems other than the Niagara above mentioned are given in Figure No. 22, which shows the resulting rate per kw.-hr. and per horsepower-year.

Figure No. 21 showing the base retail power rates for several municipalities of the Niagara System, indicates that the power rate for London is lower than that for Toronto for the year of 1920. It is rather difficult to conceive why London should earn the lower power rate, when not only the investments made by the Commission on its behalf is higher per horsepower purchased than is that for Toronto, but the interim rate quoted for 1920 was \$19.00 per horsepower-year compared to \$17.00 per horsepower-year for Toronto and the actual wholesale rates per horsepower year paid by the two municipalities was \$20.40 for Toronto and \$23.60 for London, a difference of \$3.20.

The domestic rates quoted for the two municipalities are identical, and the commercial rates for Toronto are higher than those for London. On the other hand, the municipal street lighting rates are \$10.00 for 75-watt fixtures for London, compared to a range of \$8.00 to \$10.00 for 100-watt fixtures for Toronto.

There is not enough difference between the rates for service for classes other than power to account for the lower power rate which power customers in the municipality of London enjoy. It is possible that the difference in the rates to power customers for these two municipalities results from the efficiency

of operation by the Municipal Commissions. For instance, the total expense for the operation of the Local Commission for London in 1920, including depreciation, amounted to about \$43.00 per horsepower-year, and the revenues received yielded over this expense a 5% surplus. On the other hand, the operating cost for the operation of the Municipal Commission in Toronto amounted to \$52.00 per horsepower-year, and revenues yielded above this expense a 4.3% surplus.

The power rate for Toronto quoted in the "Rate Book" furnished by Mr. W. G. Pierdon, Accountant for the Commission, bears a very much higher energy charge for power used at load factors exceeding 15% than does that for London, or in fact, any of the municipalities shown in Figure 21, so while the cost of power at 15% load factor is about 11% higher in Toronto than in London, at 50% load factor, it is very nearly 42% higher. By any of the accepted theories of rate-making such variation of cost with load factor between two municipalities is not comprehensible.

Another interesting and incomprehensible comparison of power rates is that between Hamilton and Niagara Falls for the years of 1920 and 1921. The base retail rates for power for these municipalities, for each year, are shown in Figure 23. The interim rate billed against the municipality of Niagara Falls was increased by 8.7% in 1921 over that of 1920, while the base retail power rate which the municipality was ordered to charge was increased at 25% load factor by 23.2%. On the other hand, the interim rate billed to Hamilton for 1921 was increased by 14.3% over that of 1920, while the base retail power rate which the municipality was ordered to charge for power was decreased at 25% load factor by 3.3%.

The domestic rates for Hamilton and Niagara Falls for both years were identical, while the rates for commercial service were somewhat higher for Niagara Falls than for Hamilton. For Niagara Falls, in 1921, the municipal street lighting rate was increased \$2.00 per annum for each arc light and \$1.00 for each series incandescent light, while for Hamilton they remained the same as for the preceding year.

In 1920 the operations of the Municipal Commission in Hamilton yielded a surplus of less than \$1.00 per horsepower-year, while those for the Municipal Commission of Niagara Falls yielded a surplus of more than \$2.50 per horsepower-year.

On the basis of this analysis the reason appears lacking for the lowering of the power rates at Hamilton and per contra for the increase for the same class of rates at Niagara Falls.

Power Rates to Customers of Power Companies Purchased by the Hydro-Electric Power Commission

The Ontario Power Company was purchased by the Hydro-Electric Power Commission in 1917. At that time it was selling power to the Niagara, Lockport and Ontario Power Company at \$16.76 per

Figure 21
Base retail power rates for several municipalities on
the Niagara System for 1920.

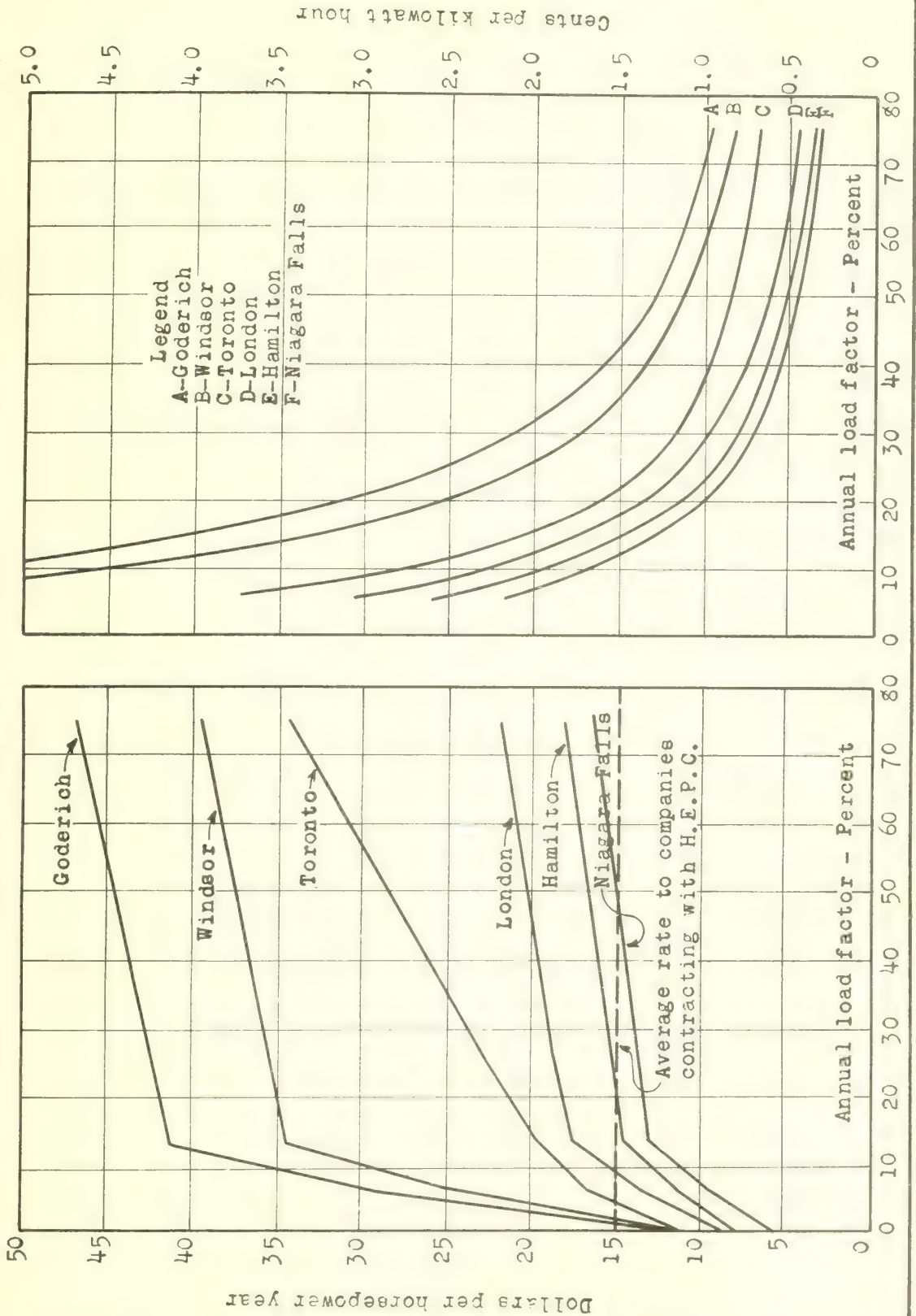


Figure 22
Base retail power rates for several municipalities on H.E.P.C. systems other than the Niagara system for 1920.

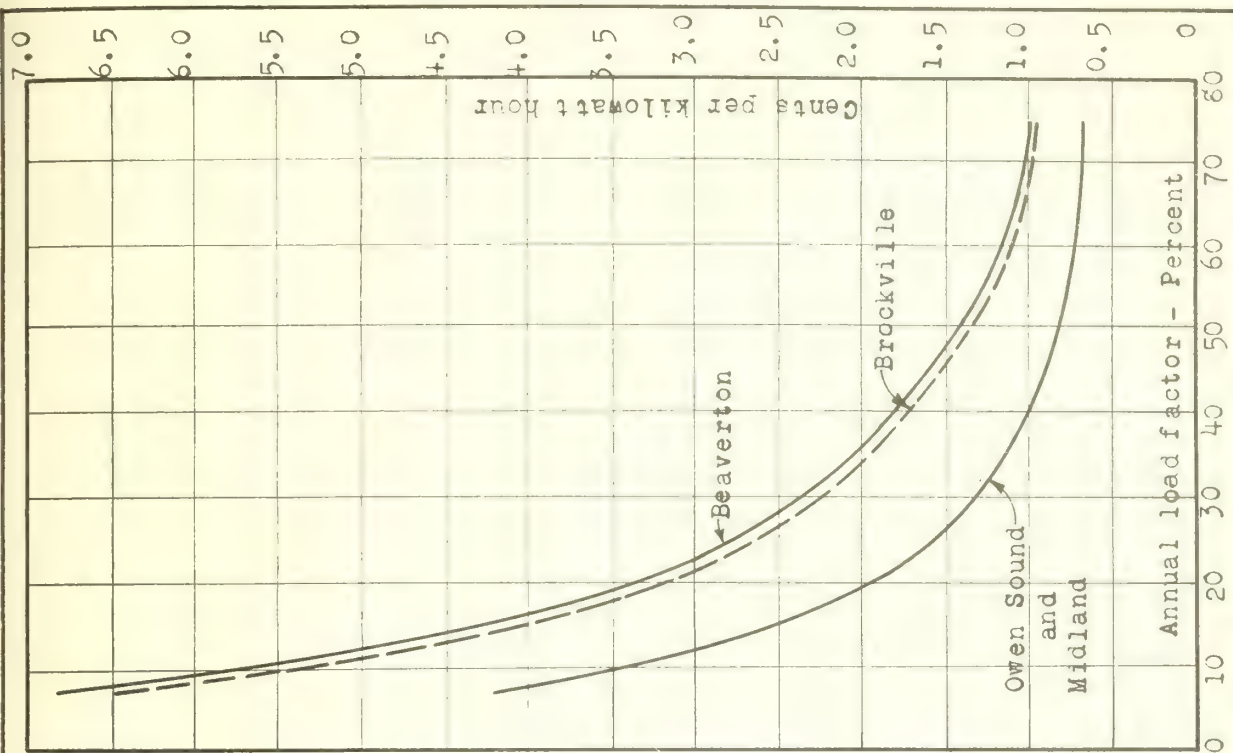
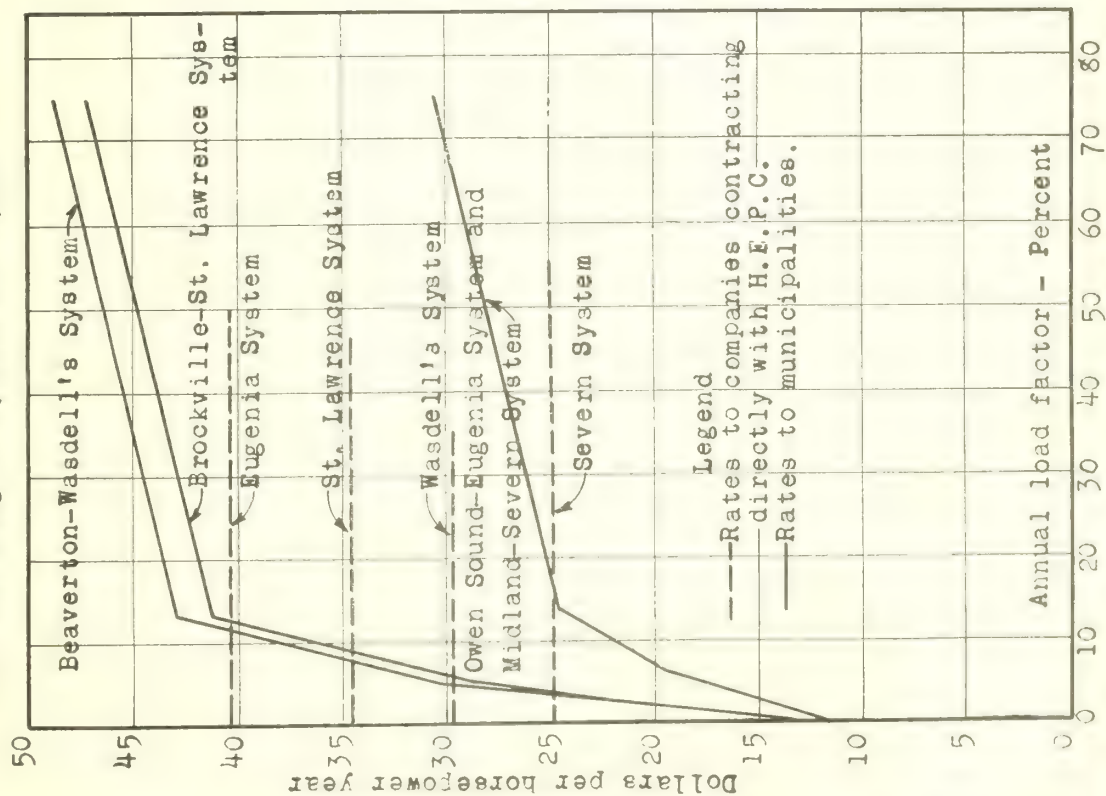
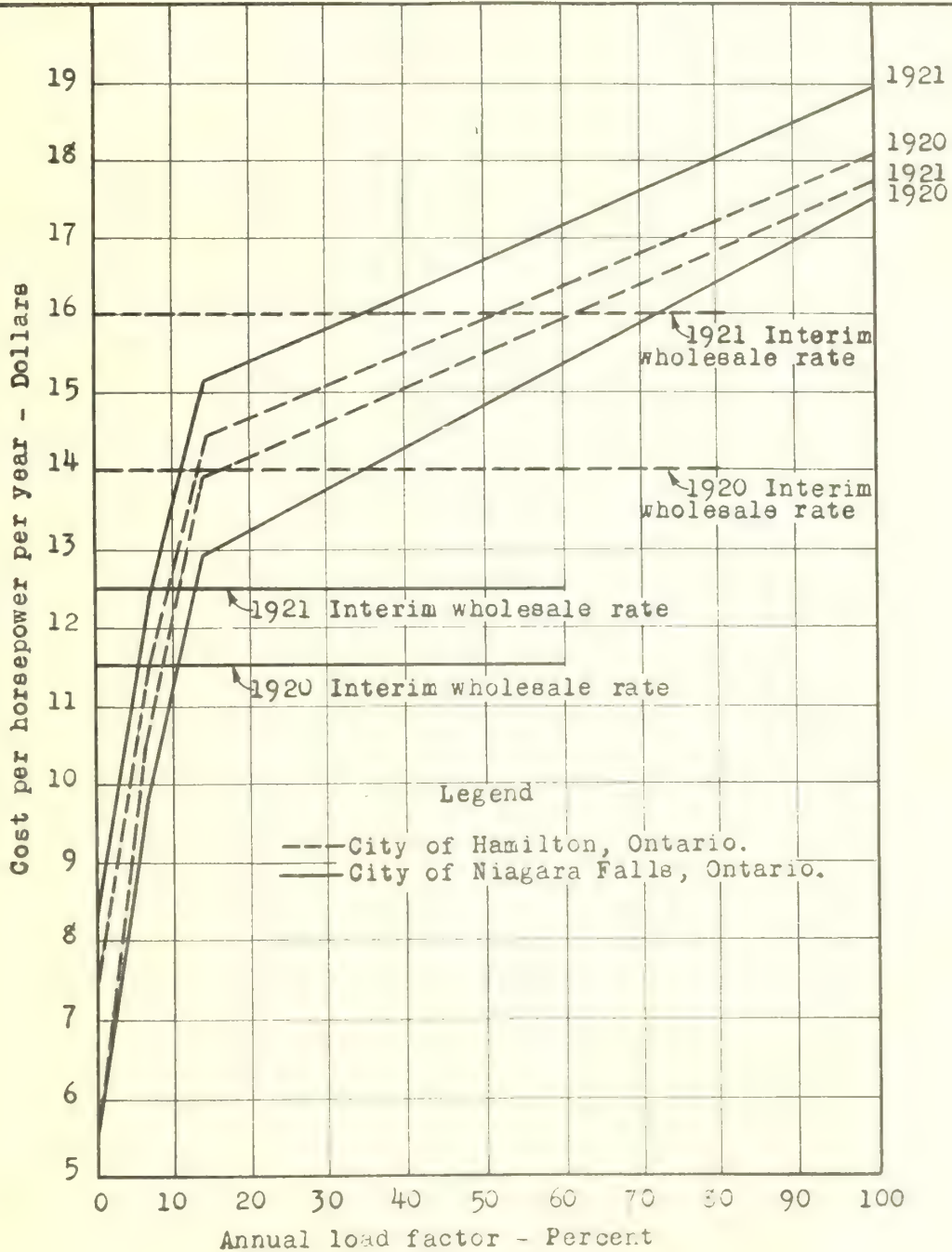




Figure 23

Base retail power rates for Niagara Falls,
Ontario compared to those of Hamilton,
Ontario in 1920 and 1921.



kw.-year of demand plus an energy rate of $2\frac{1}{2}$ mills per kw.-hr. for all energy taken over 40,000 kilowatts of demand. By the terms of the sale of the Ontario Power Company to the Commission, the Niagara, Lockport and Ontario Power Company is entitled to this rate until about 1950.

In purchasing the Ontario Power Company, the Commission further assumed a number of power contracts, some of which are on the basis of the sale of energy at a stated rate per horsepower-year of demand, others at an energy rate per kw.-hr. purchased, and still others on a combination of a demand and energy charge.

The Ontario Power Company before its purchase by the Commission was under contract to sell power to the Commission for a long period of years at \$9.40 per horsepower-year up to 25,000 horsepower, and at \$9.00 per horsepower-year for all thereafter. Since the assumption of the ownership of the Ontario Power Company, by the Commission, this rate to the municipalities of the Niagara System has been maintained up to 100,000 horsepower and these municipalities have been charged at the rate of \$18.00 per horsepower-year for power in excess of that amount.

The rates to industrial users other than those above mentioned vary in accordance with the size of the installation and the nature of the contract, being as low as \$10.50 per horsepower-year in 1920 for approximately 26,000 horsepower taken by the American Cynamide Company, to as high as \$70.00 per horsepower-year for a small block of two-tenths of one horsepower sold in Fort Coleman.

The Ontario Power Company is considered, as far as rates go, a separate entity from the Niagara System, and as far as the rate-making powers of the Hydro-Electric Power Commission are concerned, it has been considered of the same status as a private company. The Commission has respected all of the contracts assumed by it in the purchase of the Ontario Power Company, and has not attempted to regulate these rates so as to make them non-discriminatory with the balance of the Niagara System.

Practically the same status holds true for the Essex and the Thorold Systems, which have been purchased by the Commission, but which have as yet not been turned over to the municipalities, but in the case of the Central Ontario System, which was purchased by the Province of Ontario, and which is operated by the Commission in trust for the Province, the Commission has adjusted rates, some up and some down, in order to make them more uniform, and to avoid discrimination between the rates to individual consumers in the several municipalities served by this system.

With regard to the Electrical Development Company which the Commission is about to acquire, Mr. Gaby states the reasons for the proposed purchase to be:

"To conserve and prevent economic loss, due to duplication of systems within the Niagara

District and the properties could be purchased with existing contracts on a self-supporting basis."

It is evident, therefore, that the Commission will pursue the same policy in respect to the companies that will be acquired by the "Clean-up-Deal" as was pursued in the case of the Ontario Power Company, that is, rates and contracts will be left as they are at the date of purchase.

Summarization of the Status of Power Rates of the Government Electric Utilities in Ontario

If an industry is located within a municipality, it can contract for power at the rate which will be firm for a period of only one year, but if that industry should be located without the precincts of the municipality, it may contract directly with the Hydro-Electric Power Commission rather than with one of the Municipal Commissions at a rate for a period of years with a firm price extending the duration of the contract.

Again there appears another class of rates, those which are enjoyed by the consumers of the Ontario Power, which have been left as they were at the time of the purchase of that company by the Hydro-Electric Power Commission, and still, lastly, upon the completion of the "Clean-up-Deal," there will be two rates for power service in the City of Toronto, those charged by the Municipal Commission in Toronto, and those to the consumers of the Toronto Electric Light Company, which, judging by Mr. Gaby's statement, it is assumed will be left as they were on the date of purchase. Thus it appears that the rate system of the government electric utilities, throughout the Province of Ontario, is made to meet the demand of the moment rather than to furnish a uniform and non-discriminatory rate to the public.

The Coal Saving Accruing as a Result of Rates Resulting from the Development of the Water Powers of Ontario

Practically all of the power furnished by the Hydro-Electric Power Commission of Ontario is developed by water power, there being no steam electric plants of any importance on any of the systems. Had the energy now furnished by water power been supplied by steam electric plants, a very large tonnage of coal would be required for the generation of the power, and this coal would have to be imported into Ontario either from Nova Scotia or from the States.

At the hearing before the Committee on Water Power of the House of Representatives, held April 15, 1919, Sir Adam Beck said:

"You may like to know what benefit accrued to the country on account of all this expenditure. We have reduced, by five or six million tons per annum the consumption of bituminous coal in the Province of Ontario. We have reduced the freight haul on all of this coal (the use of cars to haul the coal), and, to a large

extent, eliminated the obnoxious smoke that is created by the use of coal for manufacturing purposes in towns and villages."

Later, at the hearing, Sir Adam presented a statement, and, under coal statistics, the following is found:

"The amount of bituminous coal imported into Western Ontario in the district served by the Niagara System was, in 1914, 5,377,777 tons valued at \$8,921,708. In 1915 there was 3,979,499 tons, valued at \$6,178,459 or a reduction of 1,398,278 tons. This result can be accounted for in some measure by the extensive use of Hydro power in this district. During the same period the imports of anthracite coal remained practically the same, being as follows:

	Tons
"1914	1,715,924
"1915	1,799,197

"The Commission is supplying in Ontario over 200,000 horsepower. The quantity of coal necessary to develop this amount of power at the consumers' premises throughout Ontario is estimated at considerably more than 4,500,000 tons, having a money value exceeding \$20,000,000, under normal conditions. At the present time this coal would no doubt cost in excess of \$30,000,000."

Sir Adam Beck, in the statement above, estimates a saving of 4,500,000 tons per annum by means of the Commission supplying 200,000 horsepower in the Province of Ontario at that time. It is difficult to see how this result is arrived at, because this amount of coal would mean that 22.5 tons would have to be used for each horsepower-year, and it is hardly conceivable that the load factor in the Province of Ontario would be higher than the present load factor for the Superpower Zone, the most in-

tensely developed industrial district in the United States, which is 39%. At 39% load factor the use of 22.5 tons of fuel per horsepower-year results in a fuel rate for the generating plants of 17.8 pounds of coal per kw.-hr., and it is hardly possible that plants of such abnormally low efficiency would have been used where fuel is expensive, as it is in Ontario.

In a report prepared by the Hydro-Electric Power Commission's engineers, dated February 15, 1918, entitled "The Rate of Coal Consumption in Various Electric Generating Stations and in Industrial Establishments in Canada and the United States," there is given on Page 4 a tabulation of the fuel consumption of 750,000 horsepower of steam electric central stations. This table shows the fuel consumption of these stations, which are operated at an average load factor of 35.5% to be 3.81 pounds of coal per kw.-hr., and at this coal rate and load factor, the fuel consumption per horsepower-year would be 4.85 tons rather than 22.5 tons indicated in Sir Adam Beck's statement, presented before the Committee of Water Powers in the House of Representatives, and the saving instead of being 4,500,000 tons per annum, as given in Sir Adam Beck's statement, would have been about 970,000 tons per annum derived from the rate of 4.85 tons per horsepower-year, as found by the Commission's engineers in their report of February 15, 1918.

The use of water power in the Province of Ontario, particularly that of Niagara Falls, which should be one of the cheapest developments in the world, cannot help but result in low rates for electricity, and it is a tremendous factor in the conservation of coal, even though not to the extent brought out by Sir Adam, and this saving in the use of coal is one which is of the utmost importance to the Province of Ontario today, for the reason that on every ton of coal imported into the Province from the States, the exchange rate would have to be paid, which would have amounted, during the past year, to a sum varying between 7 and 14 per cent.

SECTION I—(Part II)

COMPARISON IN RESPECT TO THE COST FOR POWER TO THE PEOPLE OF THE PROVINCES OF ONTARIO AND QUEBEC AND FOR CERTAIN SECTIONS OF THE UNITED STATES

General Comparisons of the Cost of Power

The cost for power to the people as a whole must be that of the weighted average cost for energy delivered to the ultimate consumer. Comparing one class of service only results in fictitious conclusions, for should the particular class of service selected show that energy is sold at low prices, or even at a price below cost, the rates charged for energy for other classes of service must, of necessity, be correspondingly higher unless the properties are operated at a deficit.

For instance, where the price for domestic lighting is below cost, the rates charged for industrial

power must be higher than those that could be charged if the domestic lighting service were charged with its proper proportion of cost. When such a situation occurs, the people, as a whole, do not escape the increased costs for industrial power service, for this is indirectly charged into the price for every manufactured article produced through the use of industrial power.

Unless all of the conditions surrounding published rates for the several classes of service are known, the comparison of prices resulting from these rates may be very misleading, and to avoid making comparisons which might properly be subject to criticism, the average cost of energy to the people served is used as the criterion for all the comparisons made.

The physical conditions under which power is produced, transmitted and distributed materially affects the price at which energy may be sold, and

while it is obvious that it would be unfair to compare the cost for power produced by steam electric plants using high-priced fuel with that produced by hydro-electric plants, it is also apparent that comparisons made for the cost of power using hydro-electric plants must take into consideration the nature of the water supply to these plants.

The power produced by the Hydro-Electric Power Commission of Ontario comes principally from the hydro-electric plants at Niagara Falls. In fact, 87% of the total energy sold by the Commission is generated by those plants. There is no other place within the United States or Canada where power should be produced as economically, for the physical conditions at Niagara Falls lend themselves to construction of low first cost, which, when combined with continuous water supply, should result in the cheapest power produced on the American Continent.

The data on which the costs of power given later are based have, for the private companies, been obtained either from the officers of the companies or from the Public Service Commissions of the states within which they operate, while those pertaining to the operation of the government electric utilities in the Province of Ontario have been obtained from the annual reports of the Hydro-Electric Power Commission of Ontario, or from Mr. W. G. Pierdon, the Commission's Accountant, where the data required was not published in the annual reports.

The kilowatt hours annually sold to the ultimate consumer is available from the statistics kept by private companies, but not for the government electric utilities in Ontario, and it is therefore necessary to make the comparisons at the point of generation rather than at the point of delivery. Such comparisons favor the government electric utilities of Ontario for the reason that the transmission distances to reach their customers are generally greater than are those of the private companies, compared thereto, and this must result in the ulti-

mate consumer receiving a proportionally smaller amount of the energy produced within the power plants.

In Ontario the government electric utilities are relieved from paying taxes except those on land, and in order to make the comparisons equitable, revenues less taxes is, in all instances, used. The relief from taxes, while making it possible to lower the costs for power, is not a reduction in the cost to the people, for they must pay these same taxes in some other form, whether they be a consumer of power or not.

For the comparisons between government electric utilities in Ontario and those for privately operated companies, the Central Ontario System of the Hydro-Electric Power Commission is omitted for the reason that the costs given in the annual report of the Commission do not segregate the operations of the light and power developments from those of street railways, gas works, water works and pulp mills, therefore making it impossible to determine the cost of power to the people residing in that portion of Ontario served by the Central Ontario System. All of these systems of the Hydro-Electric Power Commission are included, however, in the statistics prepared by the Dominion Census of Central Stations.

The Relative Cost of Power to the People of the Provinces of Quebec and Ontario

The Dominion Bureau of Statistics publishes each year a census of the "Central Electric Stations" in Canada from which the following information has been either directly taken or computed.

Both in the Provinces of Ontario and Quebec by far the larger amount of power is developed by means of water so that the conditions under which the power is generated are comparable.

While the figures published by the Dominion Bureau of Statistics do not take into consideration power interchange between the two provinces, ex-

TABLE NO. 20

DOMINION STATISTICS IN RESPECT TO THE COST OF POWER IN QUEBEC AND ONTARIO

<i>Item</i>	<i>Unit</i>	<i>Ontario</i>	<i>Quebec</i>
Total investment.....	\$1,000	192,908	130,000
Investment per capita.....	Dollars	73.50	52.40
Proportion of total capital in government owned electric utilities.....	Per Cent	49.7	4.0
Total revenue	\$1,000	26,007	16,554
Per cent of revenue from government owned electric utilities.....	Per Cent	60.0	5.0
Total operating expense.....	\$1,000	16,021	9,326
Generating capacity.....	K.V.A.	661,555	497,559
Generating capacity per capita.....	K.V.A.	0.252	0.20
Proportion of total capacity in government owned utilities.....	Per Cent	35	2.8
Revenue per dollar of invested capital.....	Cents	13.5	12.7
Operating expense per dollar of invested capital.....	Cents	8.3	7.2
Operating ratio	Per Cent	61.3	56.5
Salaries and wages per dollar of invested capital.....	Cents	3.01	1.94
Per cent of total operating expense in salaries and wages.....	Per Cent	36.3	27.1
Average annual salary or wage per employee.....	Dollars	1,225	1,055
Revenue per employee.....	Dollars	5,500	6,920
Revenue per dollar of salaries and wages.....	Dollars	4.49	6.65
Proportion total revenue from light.....	Per Cent	27.6	26.6
Proportion total revenues from power and other uses.....	Per Cent	72.4	73.4

cept as to the revenue derived therefrom, such interchange compared to the total amount of power generated is insignificant.

The figures given in Table No. 21 demonstrate that the cost of power to the entire people of the Province of Quebec is less than that for the people of Ontario. The figures not only reflect more economical operation through a lower operating ratio in the Province of Quebec, but higher productivity is shown for salaries and wages paid.

The revenue per dollar of invested capital is 9.45% greater for Ontario than for Quebec. The operating expense per dollar of invested capital is 15.3% greater in Ontario than for Quebec, while salaries and wages per dollar of invested capital are 55.2% higher for Ontario than for Quebec. Greater productivity of labor in the Province of Quebec is indicated by the larger revenue per dollar of salaries and wages to the extent of 32½%.

The Relative Cost for Power to the People of the Dominion of Canada when Served by Privately Owned Corporations as Compared with Government Owned Electric Utilities

From the Dominion Bureau of Statistics dealing with central electric stations for the year ending January 1, 1920, the following information has been derived:

About 75% of the capital invested in government electric utilities is located in the Province of Ontario. For the year 1919 these government owned electric utilities in Ontario were purchasing a portion of their total requirements from the private corporations in the Provinces of Ontario and Quebec, and as the Dominion Statistics do not indicate the extent of such purchased power, it is not possible to use the comparative revenue and expense per dollar of capital invested without doing injustice to the governmental electric utilities.

The lower operating ratios and the more efficient utilization of labor, as shown in Table No. 21 for the privately owned electric utilities in the

Dominion of Canada, indicates they are the more economically operated.

Government ownership advocates advance the theory that economical operation and lower salaries and wages prevail for governmentally operated properties. This theory does not appear to work out in practice in Canada, for there, according to the Government Statistics, not only are higher salaries and wages paid per employee, but the total revenues earned for each employee is 28% lower and the revenue earned for each dollar paid in salaries and wages is over 31% lower for the government-owned electric utilities than for those owned by private interests.

The claim which has been advanced that government-owned projects lean toward selling energy to the domestic consumer at a low rate is borne out by the relative proportions of revenue obtained from lighting and for power for the governmentally owned utilities compared to those privately owned.

Statistics in Respect to the Operation of Private and Government-owned Electric Utilities in the Provinces of Quebec and Ontario

The Dominion Bureau of Statistics so segregates its tabulations that it is possible to compare, as of January 1, 1920, the government operated electric utilities with those privately owned for both the Province of Quebec and Ontario.

Government agencies in the Province of Ontario in the year mentioned owned approximately one-half of the electrical utilities in that province, and derived about two-thirds of the revenue therefrom. In Quebec, however, the government owned utilities are a small portion, consisting of only about 4% of the investment, and receiving only about 5% of the revenue therefrom.

In the Province of Ontario during 1919, the government electric utilities purchased a portion of their energy from privately owned companies located both in the Provinces of Ontario and Quebec, and as the Dominion Statistics do not take into

TABLE NO. 21
DOMINION STATISTICS IN RESPECT TO THE COST OF POWER IN CANADA FROM PRIVATE
AND GOVERNMENT OWNED ELECTRIC UTILITIES

Item	Unit	Private Electric Utilities	Government Electric Utilities
Total capital invested.....	\$1000	287,568	128,954
Proportion of capital invested.....	Per cent	69.0	31.0
Total annual revenue.....	\$1000	35,553	22,301
Proportion of total revenue.....	Per cent	61.5	38.5
Total operating expense.....	\$1000	19,202	15,140
Proportion of total operating expense.....	Per cent	56.0	44.0
Total generating capacity.....	K. V. A.	1,115,494	375,266
Proportion of total capacity.....	Per cent	75.0	25.0
Operating ratio.....	Per cent	54.5	67.7
Proportion of operating expense in salaries and wages.....	Per cent	30.1	36.7
Average salary or wage per employee.....	Dollars	1,161	1,225
Revenue per employee.....	Dollars	6,870	4,970
Revenue per dollar of salary and wages.....	Dollars	5.91	4.05
Revenue from lighting.....	Per cent	29.2	44.2
Revenue from power and other properties.....	Per cent	70.8	55.8

consideration this interchange of power, it is impossible to give a complete analysis of the figures as was done in the comparison between the cost of power to the people of Quebec and Ontario without respect as to whether such power was furnished by private utilities of government utilities.

That the privately owned utilities are more efficiently operated is indicated by the figures from the following:

electric utilities in the Province of Quebec have been omitted from this latter analysis owing to their unimportance.

In Table No. 22 the operating ratio indicates more efficient management on the part of the private companies than those governmentally owned. That part of the operating expense contributed to by salaries and wages should be less for the governmentally operated utilities than for those privately

TABLE NO. 22
DOMINION STATISTICS IN RESPECT TO THE COST OF POWER IN QUEBEC AND ONTARIO
FROM PRIVATE AND GOVERNMENT OWNED ELECTRIC UTILITIES

Item	Unit	Ontario		Quebec	
		Private Companies	Government Electric Utilities	Private Companies	Government Electric Utilities
Total capacity.....	K. V. A.	457,568	236,527	507,779	13,810
Total capital invested.....	\$1000	96,998	95,910	124,852	5,148
Total revenue.....	\$1000	10,394	15,613	15,739	814
Total operating expense.....	\$1000	5,152	10,869	8,854	472
Total salaries and wages.....	\$1000	1,947	3,837	2,338	186
Operating ratio.....	Per cent	50.0	69.8	56.5	58.2
Salary and wages per employee for year.....	Dollars	1,230	1,220	1,050	1,060
Proportion of operating expense in salaries and wages	Per cent	37.7	35.3	26.4	39.5
Revenue per employee.....	Dollars	6,560	4,980	7,080	4,650
Revenue per dollar of salary and wage.....	Dollars	5.32	4.07	6.71	4.38
Number of employees.....		1,584	3,139	2,219	175
Proportion of revenues from lighting.....	Per cent	19.4	33.0	24.1	77.0
Proportion of revenue from power and other uses	Per cent	80.6	67.0	75.9	23.0

The Dominion Statistics divide the central station companies into two classes, namely, generating and non-generating companies. In the former are placed all companies owning power plants, the figures for them being inclusive of all expenses, of production, transmission, distribution and utilization. The non-generating companies are purchasers of power only, having no investments in power plants, and no production costs other than power purchased. The Municipal Hydro Commissions of Ontario purchasing power from the Hydro-Electric Power Commission of Ontario fall into this latter group, where such municipalities do not own power plants on their own account.

The following tabulation in respect to the salaries and wages of both groups—that is, generating and non-generating companies—divided into privately and governmentally owned electric utilities brings out the more efficient use of labor by the private companies in both provinces. The government

owned, if the theories advocated by governmental ownership are correct, due to the lack of high-salaried executives, and the greater efficiency which they derive from labor. However, the results shown by the Dominion Statistics for these two provinces are the same as those for the total of Canada, and indicate a less efficient use of labor for the government-operated projects.

For all of the utilities shown in Table No. 22, the difference between the average wage paid each employe is very slight. However, the crux of the matter is not so much the average salary or wage paid as the revenue earned per employe which is the measure of the efficiency of the organization, and this is a fair basis of comparison where the source of power, namely water power, is the principal one employed by all the groups compared. Table No. 22 further shows that the revenue earned per employe for the private electric companies of Ontario was 31½% greater, and for the private companies

TABLE NO. 23
DOMINION STATISTICS IN RESPECT TO THE COST OF POWER IN ONTARIO AND QUEBEC
FROM GENERATING AND NON-GENERATING COMPANIES

Item	Unit	GENERATING COMPANIES			NON-GENERATING COMPANIES	
		Ontario Private	Ontario Government	Quebec Private	Ontario Government	Quebec Private
Number of employees.....		1,139	658	1,896	2,448	168
Average salary or wage per employee.....	Dollars	1,265	1,250	1,050	1,225	1,010
Revenue per employee.....	Dollars	7,750	10,200	8,020	3,600	6,920
Revenue per dollar of salary and wages.....	Dollars	6.11	8.90	6.81	2.95	6.88

Ontario was 42% greater than for the government-operated properties of Ontario. Not only is the revenue per employe greater for private operation than for governmental, but the revenue per dollar of salaries and wages paid is much larger for the private companies than for those operated by the government.

Referring to Table No. 23, the average wage paid by either private or government electric utilities in Ontario is about the same. The privately owned generating companies show a revenue per employe of about \$7,800 as against \$10,200 for the Ontario Government generating companies. This indicates that providing the cost of labor has been properly charged by the Hydro-Electric Power Commission of Ontario that its labor efficiency is good, although undoubtedly a portion of this high revenue per employe is due to the fact that it purchases a large amount of its power. The poorest labor efficiency is shown by the non-generating Ontario government electric utilities, and these are comprised principally of the Municipal Hydro-Electric Commissions. In this class the revenue earned per employe of \$3,600 per annum is about one-half of the similar class of companies for the Province of Quebec. Inasmuch as the average wage paid per employe by the non-generating government-owned Ontario utilities is not higher than the majority of the other groups, it is apparent that far more men are required for each operation by this group.

Reverting again to Table No. 22, it will be seen that the per cent of revenue derived from lighting is higher for the governmentally owned enterprises than for those privately owned, and if, as claimed by the Hydro-Electric Power Commission, the domestic rates for lighting are the lowest in existence, it must be concluded that the rates for power from the governmental projects are as a consequence much higher than those for the privately owned enterprises. The statistics prepared by the Dominion in respect to the relative revenues from lighting and power make apparent that where the private companies are brought into competition with the government-owned utilities the former have always been able to get a larger part of the power business, for, if the government domestic lighting rates are at a very low cost or below cost, the power consumer must pay a higher rate or otherwise the entire project would show a deficit which, to date, has not been the case.

The Cost of Power to the People Living in the Niagara Power Districts in Canada and the United States in 1920

Niagara Falls, located as it is on the international border between Canada and the United States, furnishes power for use in both countries. In Canada power from this source is transmitted as far west as Windsor, a distance of some 235 miles, while in the United States the power is carried easterly to about Syracuse, which is about 150 miles from the source of generation. The districts both in Canada and the United States receiving power from Niagara Falls, either in whole or in part, are shown on

Plate 5, on which is indicated the locations of the main transmission lines for carrying the power to the various communities, together with zone lines giving the air-line distance by land over which the transmission lines must pass between Niagara Falls and the communities receiving service.

The distances to which Niagara Falls power is transmitted in Canada are greater than those in the States, the reason for this being that the area served in Canada is less densely populated. In Canada power from Niagara Falls reaches communities having a total population of about 1,200,000 people, while in the United States, even with a smaller area covered by the transmission system from Niagara Falls, the population reached by power therefrom is about 1,500,000 people.

In addition to the greater density of population in the Niagara power district of the United States, more energy per capita is used, making it necessary to supplement the power from Niagara Falls with that generated by other water power and steam electric plants. Accordingly, of the total generating capacity available to the Niagara Power District, on the American side, 39% has prime movers using steam. In the same district for Canada, and considering only the generating capacity available for use in Canada, 15% is driven by prime movers using steam.

In the American Niagara Power District for 1920, 456,245 tons of coal were used for the production of power at a total cost of \$2,827,943, while in Canada the coal used was of very small amount, inasmuch as the steam electric plants were used principally to insure the continuity of service rather than as producers of energy.

In making comparison between the Niagara Falls Power Districts of the United States and Canada, it must be clearly borne in mind that the comparison is not one of like characteristics. On one side of the border there are approximately 1,200,000 people served almost exclusively by power produced at Niagara Falls, while on the American side of the border the people are served not only by power from Niagara Falls, but by power produced in other water power plants and in steam electric plants, both of which are inherently more expensive agencies for production.

The power plants on the Canadian side of the border at Niagara Falls had a total capacity in 1920 of approximately 318,000 kilowatts, while the capacity of those on the American side was 275,000 kilowatts. However, in 1920 the Canadian plants exported to the United States about 70,000 kilowatts, making a capacity available to the Canadian Niagara Power District of 248,000 kilowatts, and that to the United States of about 345,000 kilowatts. Thus, while the plant capacity at Niagara Falls is smaller on the American side, the capacity available to the United States is 58% of all of the capacity at the Falls. These amounts represent only the capacity of the plants in operation as of 1920, and do not include the capacity of the plants now being con-

PLATE 5

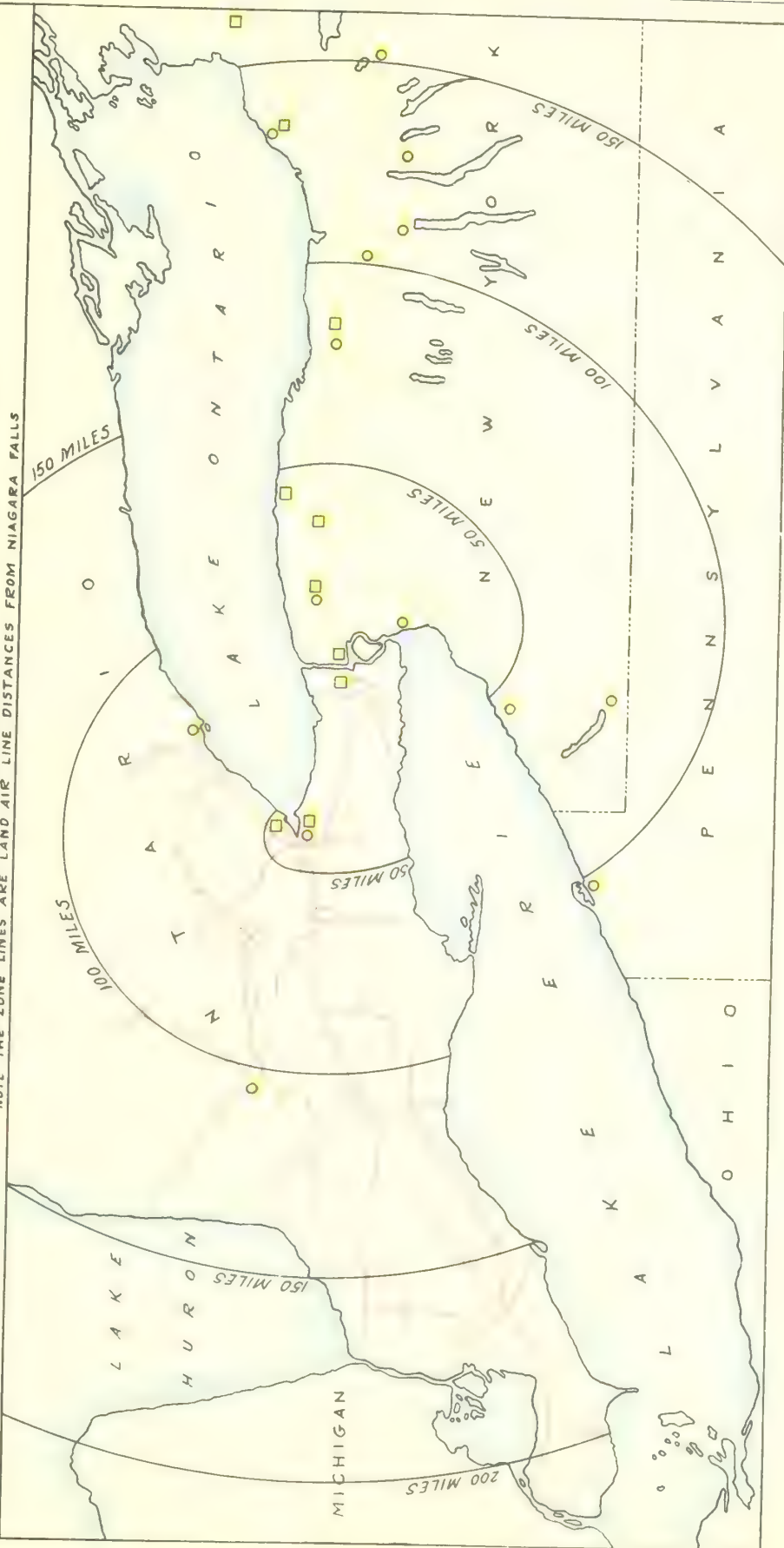
DISTRICTS SERVED FROM NIAGARA FALLS IN THE UNITED STATES AND CANADA

MURRAY & FLOOD.

NEW YORK, N.Y.

JAN. 3, 1922.

LEGEND:
 ○ TRANSMISSION LINES CONNECTED TO PLANTS AT NIAGARA FALLS IN CANADA
 □ TRANSMISSION LINES CONNECTED TO PLANTS AT NIAGARA FALLS IN UNITED STATES
 ○ PRINCIPAL STEAM-ELECTRIC POWER PLANTS
 □ PRINCIPAL HYDRO-ELECTRIC POWER PLANTS
 NOTE—THE ZONE LINES ARE LAND AIR LINE DISTANCES FROM NIAGARA FALLS



structed on the Canadian and American sides of the river.

Figure 24 illustrates the relative average cost for power to the people residing in the Niagara Power Districts of both countries and, notwithstanding the use of the large amount of steam-generated power in the Niagara District of the United States, the cost of power to its people is approximately 17% less than that to the people served by the Hydro-Electric Power Commission of the Niagara district in Canada who use power wholly produced by the plants at the Falls.

The Hydro-Electric Power Commission, in purchasing the Ontario Power Company, assumed a long-term contract to supply power to the Niagara, Lockport & Ontario Power Company at a price of approximately \$16.78 per kilowatt-year of demand. The total operations of the Hydro-Electric Power Commission in the Niagara District resulted in an average cost of 7.35 mills per kilowatt-hour generated, but the cost of power to the people served by the Commission in Canada because of the contract with the Niagara, Lockport & Ontario Power Company is increased to 9.25 mills per kilowatt-hour generated.

The Hydro-Electric Power Commission also assumed certain power contracts on the Canadian side of the border when it purchased the Ontario Power Company. The law under which the Commission operates provides that the municipalities who are the owners of the system shall be credited with any profits accruing from contracts made by the Commission and, *per contra*, shall be charged with any losses resulting therefrom.

Many of the contracts on the Canadian side assumed by the Commission in the purchase of the Ontario Power Company bear rates lower than those at which power is sold to the municipalities, resulting in an average cost to the people residing within the municipalities of the Niagara District served by the Hydro-Electric Power Commission of 11.1 mills per kilowatt hour, compared to 7.35 mills per kilowatt hour generated for all of the operations of the Commission.

The private companies operating within the Niagara District in Ontario obtain a revenue of 7.6 mills per kilowatt hour generated, which, when combined with the revenues of the government electric utilities, reduces the total revenue per kilowatt hour generated to 8.78 mills, which figure may be considered as representative of the cost of power to the people in the Niagara District in Canada.

In the United States about 33% of all of the energy generated for use in the Niagara District is produced by steam electric plants having a total capacity of about 270,000 kilowatts compared to 397,000 kilowatts in the water power plants delivering power into the district. Of the total energy generated for use in this district, 286,200,000 kilowatt hours are produced by steam electric plants, which operate at an annual capacity factor of approximately 10%.

In Canada, the Hydro-Electric Power Commis-

sion, with the local Municipal Commissions and the few private companies respectively, constitute the producers and distributors of power, while in the United States there are some 55 companies producing and distributing power in the Niagara district, of which 35 are classed as light and power companies and 20 as electric street railway companies. To ascertain the results shown in this section, it was necessary to analyze the financial statements of these 55 companies to eliminate all interchange of energy and revenue.

The resulting cost of power to the people, that is, the revenue per kilowatt hour generated for the American Niagara Power District, is about 17% less than that for the total operations of the Hydro-Electric Power Commission and Municipal Commissions for power delivered in Canada, and it is about 13% less than that for all utilities in that district, whether they be governmentally or privately operated. When compared to the cost of power to the people residing within the municipalities served by the Hydro-Electric Power Commission in the Niagara District, the cost of power to the people in the American district is less by about 4.45 mills per kilowatt hour or about 40%.

The energy produced per capita served on the American side is 28% greater than that for the operations of all of the electric utilities of the Canadian Niagara Power District, whether they be privately or governmentally operated; it is 77% greater than the energy produced for the total operations of the Hydro-Electric Power Commission, including the Ontario Power Company, and it is 134% greater than the energy produced by the Hydro-Electric Power Commission for the use of the municipalities contracting with the Commission for the receipt of power in the Niagara district.

At the same time the capacity provided for each 1,000 of population is 65% greater for the Niagara district in the United States than for the total of private and government operations in the same district of Canada. This greater capacity available to the people in the States contains the reserve capacity for insurance against interruption to service, and when comparing the two districts the reason for the power shortage from which the Province of Ontario has been suffering during the past four years is made very evident.

Figure 24, in addition to showing the revenue per kilowatt hour generated, shows the relative amounts of energy sold per capita and the proportion of water power to the total capacity.

About 70% of the total energy used within the Niagara district of the United States is used in the operation of three companies, exclusive of the power sold by these companies to other power companies within the district. The cost of power delivered by these three companies to the people is extremely cheap, and for 1920 amounted to approximately 4.64 mills per kilowatt hour, which is about 47% less than the cost for power delivered by all electric utilities in the Niagara district of Canada and notwithstanding that of the total generating

capacity available to these three companies 31% is driven by prime movers using steam. However, these steam electric plants produce only about 10% of the total energy delivered to the people by these companies.

In making comparisons of cost the actual relations of the Hydro-Electric Power Commission of Ontario to the municipalities and to companies served from its systems must be kept clearly in mind. The Commission is empowered by law to contract for the sale of power to industrial companies located outside the boundaries of the municipalities. The profits or losses resulting from such contracts are credited or debited to the cost of power to the municipalities, and the cost of power to the people served by the Niagara System is not the cost to the people living within the municipalities themselves, but the average cost over the entire system. As has been brought out in Section H, the rates charged to industrial consumers by the Commission are lower than the wholesale cost for power to the municipalities, which results in the people living within the municipalities paying an average price for power higher than those stated above.

Cost of Power to the People of California Compared to that Portion of Ontario Receiving Power from the Hydro-Electric Power Commission

From the standpoint of the physical property required to deliver power to the people, California is not comparable to Ontario. In California the water power plants are located in the mountainous regions, a considerable distance away from the markets for the power, which results in the necessity of some very long transmission lines across an extremely rugged country to bring the power to the markets.

The capacity of the water power plants in California compared to those at Niagara Falls are very small, and the total power is obtained by the construction of a large number of these rather than by the construction of the few very large plants, as is the case in Ontario. Furthermore, the water supply is extremely irregular, as it is at Niagara Falls, this being unusually well illustrated by the water famine which occurred there during 1920. In California, therefore, it is necessary to substitute the water powers by steam power, and of the total generating capacity available to that section of California installed, 41% of all of the generating capacity is located in the steam electric plants, while about 36% of all of the energy produced is accomplished through the agency of steam rather than by water.

Obviously this physical situation does not lend itself to the production of cheap power to the extent that should be reached by the electric utilities receiving power from Niagara Falls. California is hardly comparable even to the systems of the Hydro-Electric Power Commission other than Niagara, for these systems produce practically all of their energy by water powers, which are located in close prox-

imity to the markets to be served, therefore involving no large investment costs for transmission. Notwithstanding these physical differences, the operations in California are compared to those by the Hydro-Electric Power Commission other than the Niagara System, more especially to bring out the greater degree of service rendered to the people by the companies in California than is rendered to the people by the Hydro-Electric Power Commission.

Figure 25 shows the total revenues, energy generated per capita served, and the proportion of the capacity in water power for California compared to the same statistics in respect to the systems other than the Niagara operated by the Hydro-Electric Power Commission of Ontario.

The cost of power to the people of California is less by 4% than that to the people served by the systems other than Niagara in Ontario. In California, however, about 970 kilowatt hours are served per capita, which is greater by 10% than for the service received from the government electric utilities in Ontario other than the Niagara System. California receives service for a greater proportion of its population in that 197 persons out of each 1,000 of population are customers of the private companies, and this use of service in California is greater by 58% than for the systems of the Hydro-Electric Power Commission other than the Niagara, and greater by 33% than for all of the systems of the Hydro-Electric Power Commission.

The generating capacity per capita available to the districts served in California is greater by about 21% than the generating capacity made available to all of the systems of the Hydro-Electric Power Commission of Ontario, showing that in California the service to the people is better protected by reserve generating equipment than is the case for Ontario.

Cost of Power to the People of Ontario and Quebec, Served by Private Companies, Compared to the Cost from Government Electric Utilities in Ontario

The section of Quebec taken for comparison with the government electric utilities of Ontario is located in the St. Lawrence Valley, extending from the city of Quebec to the boundary between the Provinces of Ontario and Quebec. This region is served almost entirely by water power, only 7% of the total capacity located therein being comprised of steam electric plants, in which but very little energy is produced.

Of the water powers supplying this section, those producing by far the greatest proportion of the energy used are of the character receiving practically a continuous water supply, making them, in this particular, comparable with Niagara Falls. It has also been possible, due to the physical characteristics of some of these water powers, to construct them for a very low first cost, therefore in this respect they are also comparable to Niagara.

The transmission systems serving this region are expensive because the water powers are located at

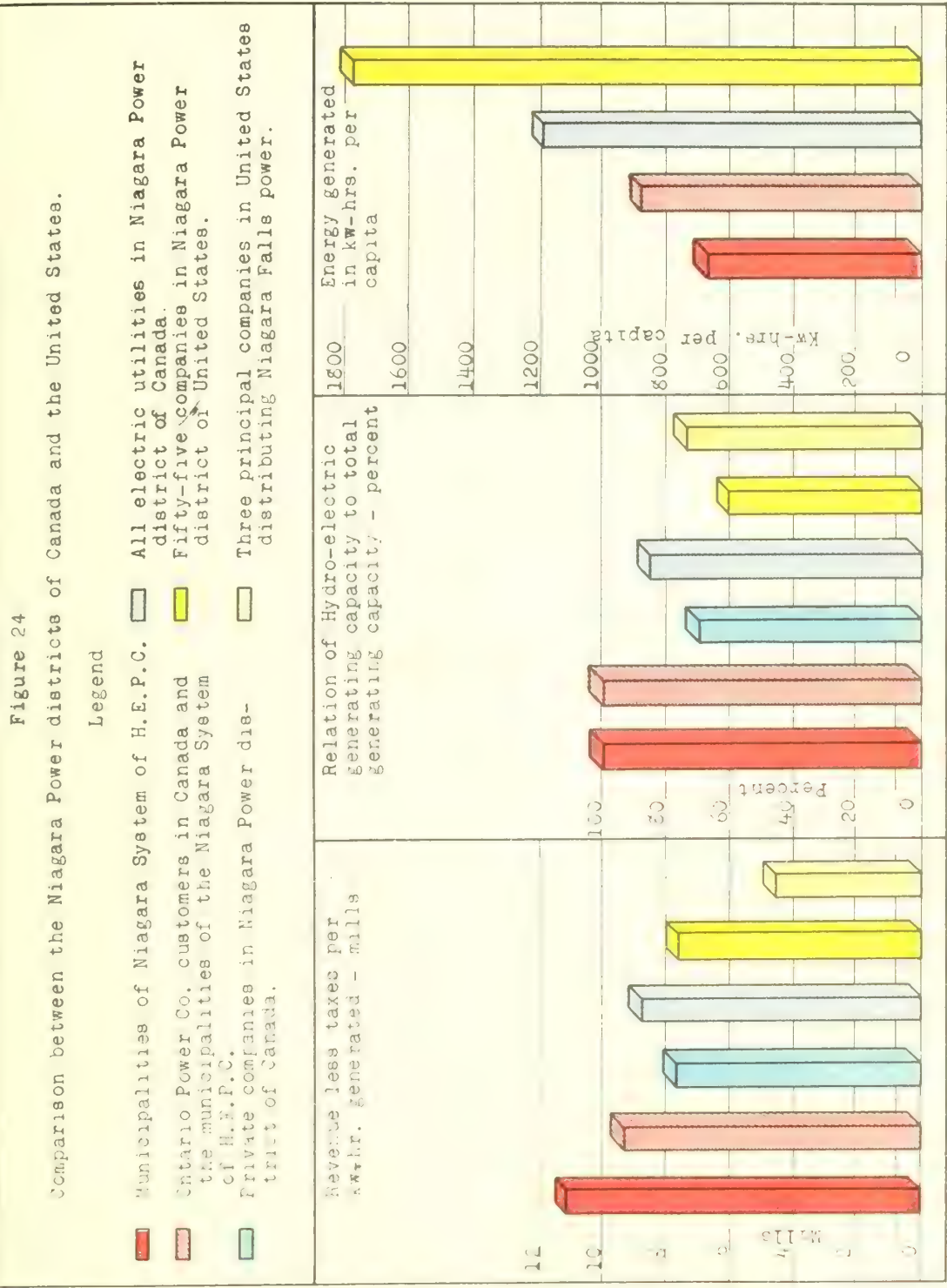


Figure 25

Comparison between the Ontario government electric utilities(exclusive of power exported to the United States)and private electric utility companies in California.

Legend

- The Ontario Government electric utilities other than the Niagara District.
- California private electric utility companies.

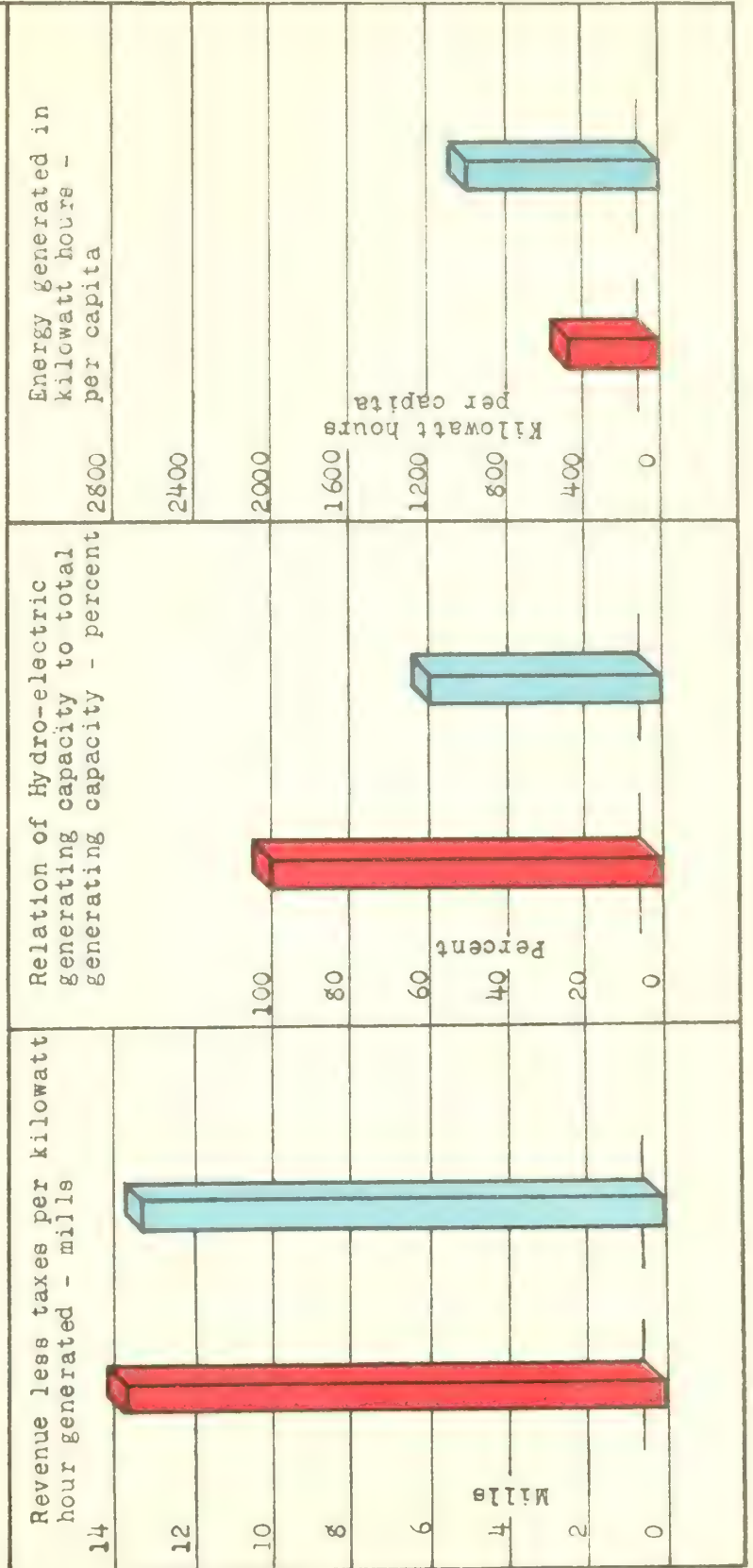
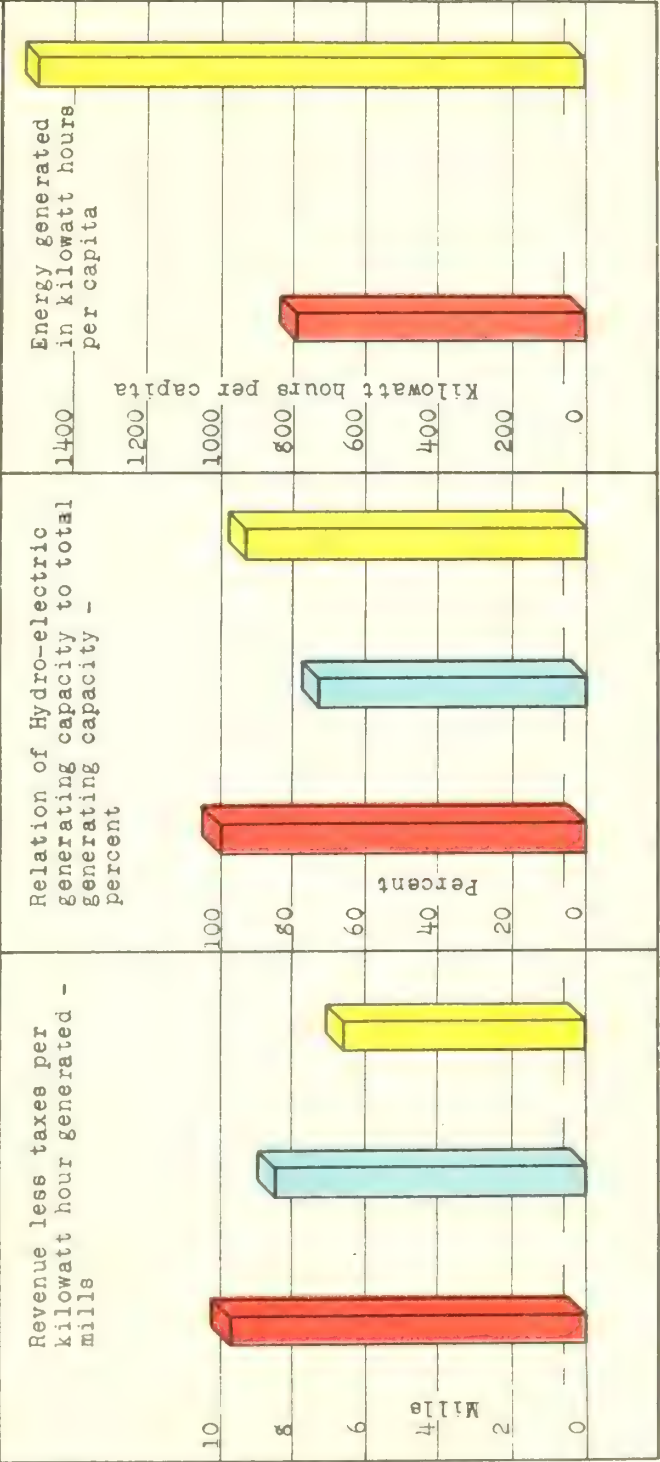
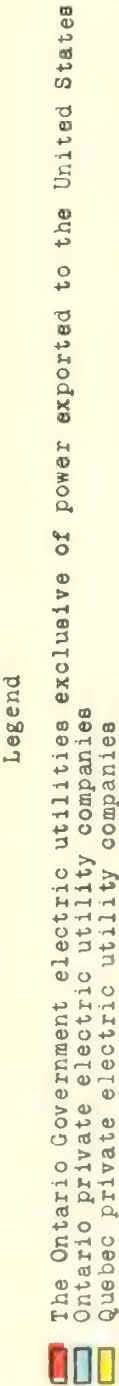


Figure 26
Comparison between the Ontario Government electric utilities exclusive of power exported to the United States, Ontario private electric utility companies and Quebec private electric utility companies.



remote distances from the power markets. Considering all of the factors making up the total cost of power to the people, this section of Quebec is more truly comparable to that of the region served by the Hydro-Electric Power Commission of Ontario than is any other section within considered.

These two districts are compared with the government electric utilities of Ontario in Figure 26.

In Ontario, the principal private companies receive a large amount of power from Niagara Falls, or from other cheap water powers, and while for the companies considered this is supplemented by approximately 27% in steam electric capacity, it is not largely used for energy production.

The cost for power to the people of Quebec is low, being 32% less than that for the cost to all of the people receiving Hydro-Electric Power service in Ontario, and being less by 27% than the cost to all of the people residing in the Niagara district of Ontario that are served by privately or governmentally operated electric utilities.

In respect to the number of kilowatt hours served per capita, the private companies in Quebec deliver 84% more than does the Hydro-Electric Power Commission to its customers in Ontario, and 24% more than do all of the privately operated and governmental electric utilities in the Niagara district of Ontario.

The service in Quebec appears to be more widely distributed in that the number of customers served for each 1,000 of population exceeds that for the operations of the Hydro-Electric Power Commission by about 9.4%, while the generating capacity available per 1,000 of population is greater by 89% than that for the Hydro-Electric Power Commission's operations, and by 19% than for the operations of all of the electric utilities in the Niagara district of Ontario.

The private companies of Ontario are furnishing power to their customers for a price of about 4.8% less than that delivered to the people by the Hydro-Electric Power Commission of Ontario. Data as to the extent of service to the customers of the private companies of Ontario was not complete, and comparisons, therefore, could not be made.

Summarization of the Comparisons Between Power Districts in Canada and United States

The preceding discussion brings out that even under conditions not favorable to the privately operated companies in the States and in Canada they are able to deliver power at a lower cost to the people than do the government operated electric utilities in Ontario. What is even more marked, however, is the greater availability of service, as not only are the kilowatt hours generated per capita served greater in each instance, but the number of customers taking service for each 1,000 of population is much larger for the private companies than for the government electric utilities of Ontario. Undoubtedly this is due to the lack of initiative by government electric utilities in securing new business once service has been established in any community.

The private electric utility companies provide a proportionately larger amount of generating capacity per capita served than do the government electric utilities, and thus, by providing larger amounts of reserve equipment, they insure a higher degree of continuity of service to their customers.

Comparisons of the Cost of Power to the People Residing in the Larger Cities in the Provinces of Ontario, Quebec and in the Niagara Power District of the United States

Toronto, which is the largest city receiving service from the Hydro-Electric Power Commission of Ontario, is compared to Montreal, the metropolis of the Province of Quebec and to Buffalo, the largest city in the Niagara district within the United States.

Toronto is located about 80 miles from Niagara Falls, while Buffalo is within 20 miles of the same point. Montreal receives its power from Cedars Rapids and from Shawinigan Falls, and the distances over which power must be transmitted from its point of production to that of utilization are comparable to the distances between Niagara Falls and Toronto.

In 1920 the Hydro-Electric Power Commission supplied Toronto without the use of any steam electric reserve located within that city. Montreal and Buffalo do have steam electric reserve, and in the latter city the steam electric plant produced in 1920 over 180,000,000 kilowatt hours.

Revenues less taxes per kilowatt hours have, in all instances, been compared, but the energy in this instance is taken on the basis of that sold to the ultimate customer rather than that generated in the power plants. Figure 27 shows the total revenue less taxes per kilowatt hour sold compared for these three cities. That for Toronto includes only the operations of the Local Hydro-Electric Power Commission. The cost of power to the people in Toronto was about 1.78 cents per kilowatt hour in 1913. It was gradually reduced until 1918, when it reached a minimum of 1.02 cents. Since that time it has risen until 1920 to 1.47 cents per kilowatt hour.

For 1913 and 1914 the average cost of power to the people in Buffalo was high, being over 3.5 cents per kilowatt hour. This is due to the small proportion of power business to the total business; however, in 1915 a very material drop in average cost took place, and the cost of power to the people in Buffalo reached a minimum of 0.93 cents in 1918, since when it has risen to 1.18 cents per kilowatt hour for 1920.

The cost of power to the people of Montreal has been very uniform over the eight-year period analyzed, starting at 1.03 cents in 1913, reaching a minimum of 0.93 cents per kilowatt hour for 1917, with an increase since that date to 1.13 cents per kilowatt hour for 1920.

For 1920 the cost of power delivered to the customers of the Toronto-Hydro-Electric Power Commission was 29% greater than that to the people of

Montreal, and was 25% greater than that to the people of Buffalo.

The increase in the cost of energy in the several cities, brought about by increases in the costs for labor and material since 1917, have been 25% for Montreal, 27% for Buffalo and 44% for service from the Toronto-Hydro-Electric Power Commission. The efficiency of management for the private electric utilities combined with regulation by Public Service Commissions seems in this instance to have been more successful in holding down average costs for service to the consumer with rising commodity prices than was government ownership.

At the hearing before the Committee on Water Power of the House of Representatives of the United States held April 15, 1918, Sir Adam Beck made the following statement:

"In Toronto we are selling power at one-half the rates obtaining in the city of Buffalo, 20 miles from the Falls, while Toronto is 84 miles from the Falls.

"We have small towns, such as Galt, 89 miles, and St. Thomas, 120 miles from Niagara Falls, where the rates are just one-half the rates that the company in Buffalo is charging for its light and power.

"Buffalo prices were fixed by your Public Service Commission, and I think they were reduced by 20% or 25% a year or so ago, but they are still twice as high as the average price at which we are supplying 200 municipalities."

It is difficult to understand the comparison Sir Adam Beck is making in the above statement. The first two paragraphs indicate a comparison between the average cost for service to the customer, and if such is the case Sir Adam must have been misinformed, for at that time the customers in Buffalo were receiving service at an average cost less by 10% than that for Hydro customers in Toronto. The last paragraph of the statement, however, compares the wholesale price of power to the 200 municipalities in Ontario with the retail rates in Buffalo. Such a comparison is obviously unjust and fallacious. This latter comparison is of the form remarked on in Section II, page 154; that is, it is a comparison between unlike units and is therefore valueless and misleading. It was to avoid just these erroneous comparisons that the method used in this report was adopted, for the comparisons between the average cost of service to the consumer is the accurate measure of the cost of power to the entire people for any section served, and it at the same time eliminates the question as to whether or not each rate schedule is so constructed as to share its proper proportion of the total cost.

The Toronto Hydro-Electric Power Commission furnishes a relatively small amount of power to the Civic Street Railways, and it furnishes only in part the domestic and industrial light and power business in the city of Toronto. In order to compare

the cost for energy to all of the people receiving electric service in Toronto to that of Montreal and Buffalo, the revenues and energy sold by the private company, including the cost of power to the street railway company, has been added to that of the Toronto Hydro-Electric Power Commission, and the comparison as to the revenue, less taxes, per kilowatt hour between these several cities is illustrated in Figure 28 for the years of 1917 to 1920 inclusive.

This figure indicates that the Toronto Hydro-Electric Power Commission was selling power in Toronto at a cost to people less than that for the private company in Toronto up to 1920, when the increase of rates, put into effect by the Commission, increased the cost to above that for the private company. The combined revenue less taxes for the city of Toronto per kilowatt hour sold is 1.35 cents as compared to 1.47 cents for the operations of the Toronto Hydro-Electric Power Commission only.

Street lighting in all cities is paid for by taxation. In Figure 29 the average cost for street lighting in cents per capita for the three cities compared is shown for the years 1913 to 1920 inclusive. The cost of street lighting per capita in Toronto in each instance is higher than that for the two other cities, and shows a greater variation in cost from year to year, varying from nearly 80 cents in 1913 to about 65 cents for 1918, with an increase to 67 cents for 1920.

In Buffalo the lowest cost for street lighting was reached in 1914, when it was 53 cents per capita, and it has gradually increased since that time until in 1920 it was about 60 cents per capita.

The cost for street lighting in Montreal is very uniform over the entire period, varying but one or two cents per capita above or below 40 cents per capita.

The relative amount of light received for this expenditure in these several cities has not been compared, due to the lack of adequate statistics. Montreal and Buffalo are well illuminated cities, and while it is possible that Toronto may have a greater amount of illumination per capita, it is entirely a question, after sufficient illumination has been provided for adequate police protection purposes, as to what degree above that the municipality desires to spend for its cost of illumination.

Figure 30 shows the proportional amount of total revenue received from different classes of services by the Toronto Hydro-Electric Power Commission, as compared to the city of Buffalo. For the past few years the revenue received from power sales are not far different, while those received from domestic and commercial lighting are somewhat greater for Buffalo than for Toronto. The proportion of revenue received from street lighting is less than one-half in Buffalo of that received for Toronto, and in the early days of the operation of the Toronto Hydro-Electric Power Commission a considerable portion of its total revenues were derived from this class of business.

Figure. 27

The total revenue less taxes per kilowatt hour sold for the cities of Buffalo and Montreal compared to Hydro in the City of Toronto.

Legend.

- Hydro energy in the city of Toronto (From annual reports T.H.E.C.)
- Buffalo General Electric Company.
- Montreal Light Heat and Power Consolidated (Montreal City System Only.)

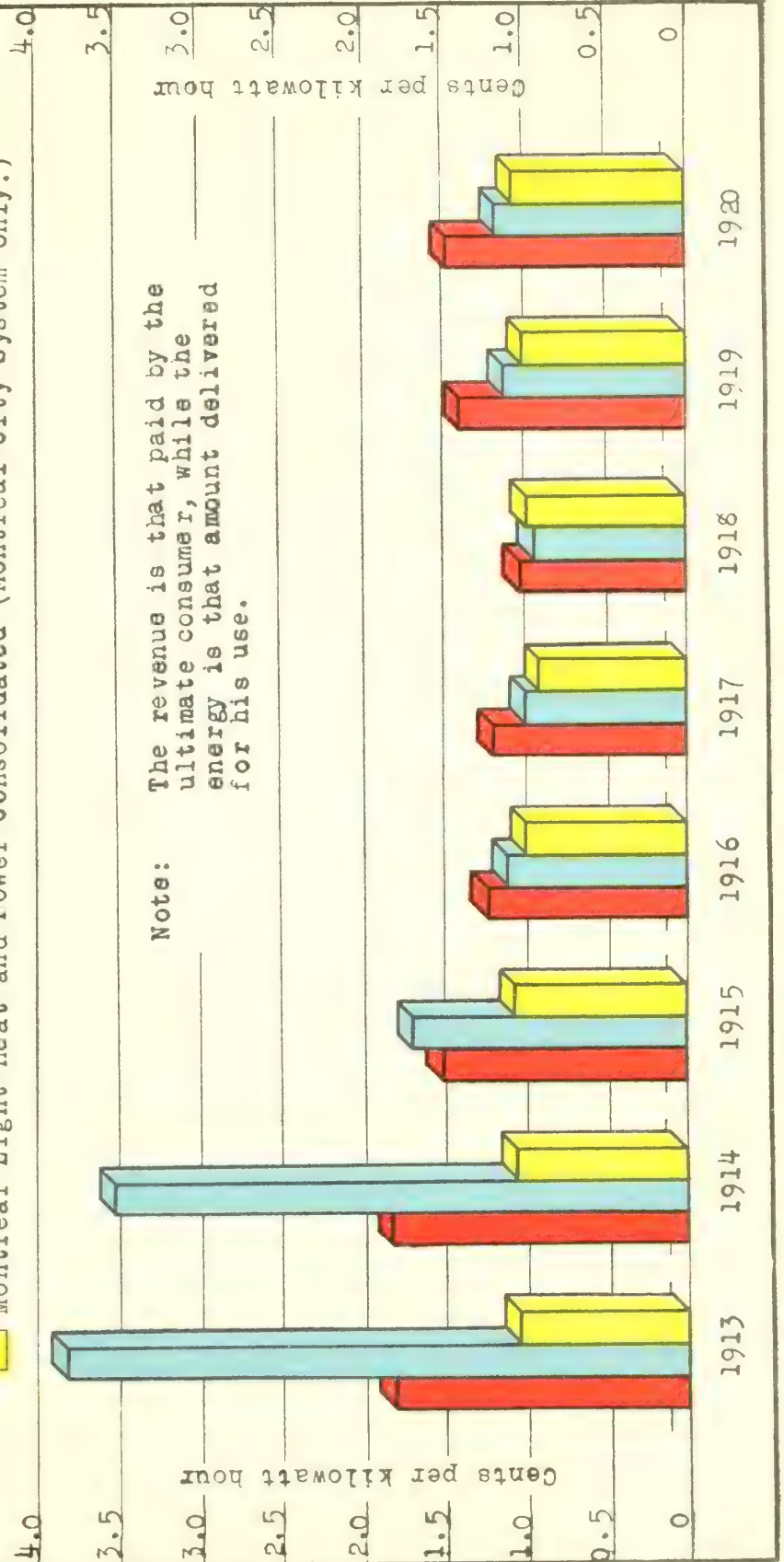




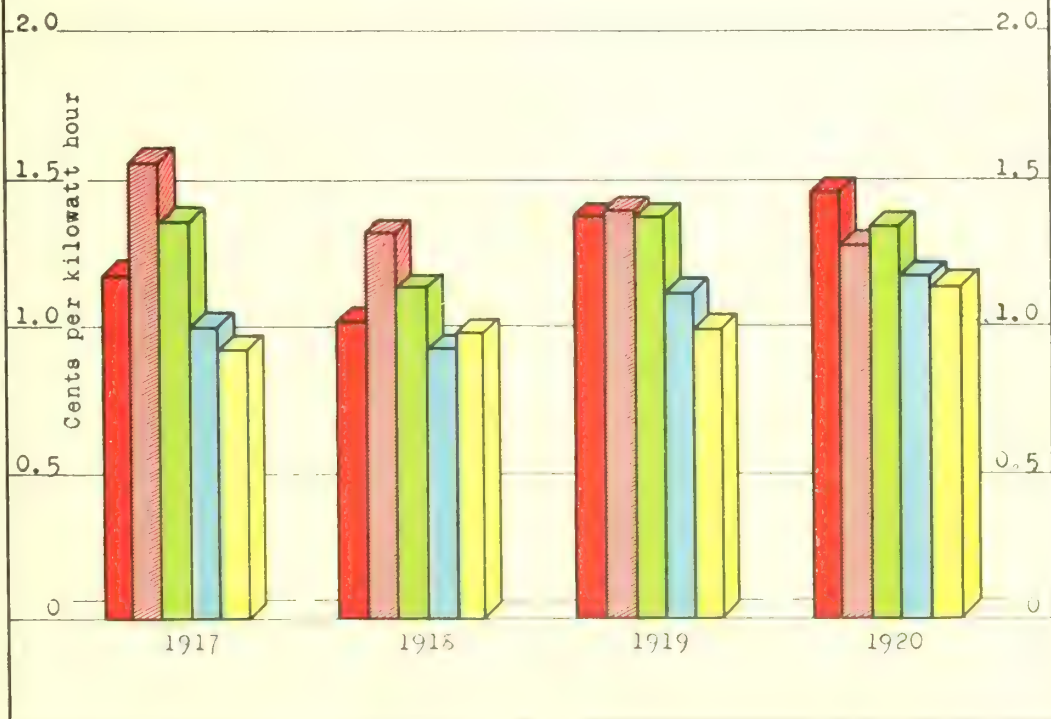
Figure 28

The revenue less taxes per kilowatt hour for the cities of Buffalo and Montreal compared to the city of Toronto including both the municipally owned and privately owned Electric Utility properties.

Legend

- For Toronto Hydro Commission customers.
- For Toronto Electric Co. customers and Toronto Railway Co.
- For all Electric Utilities, City of Toronto, Ontario.
- For all Electric Utilities, City of Buffalo, New York.
- For all Electric Utilities, City of Montreal, Quebec.

Note: The revenue is that paid by the ultimate consumer, while the energy is that amount delivered for his use.



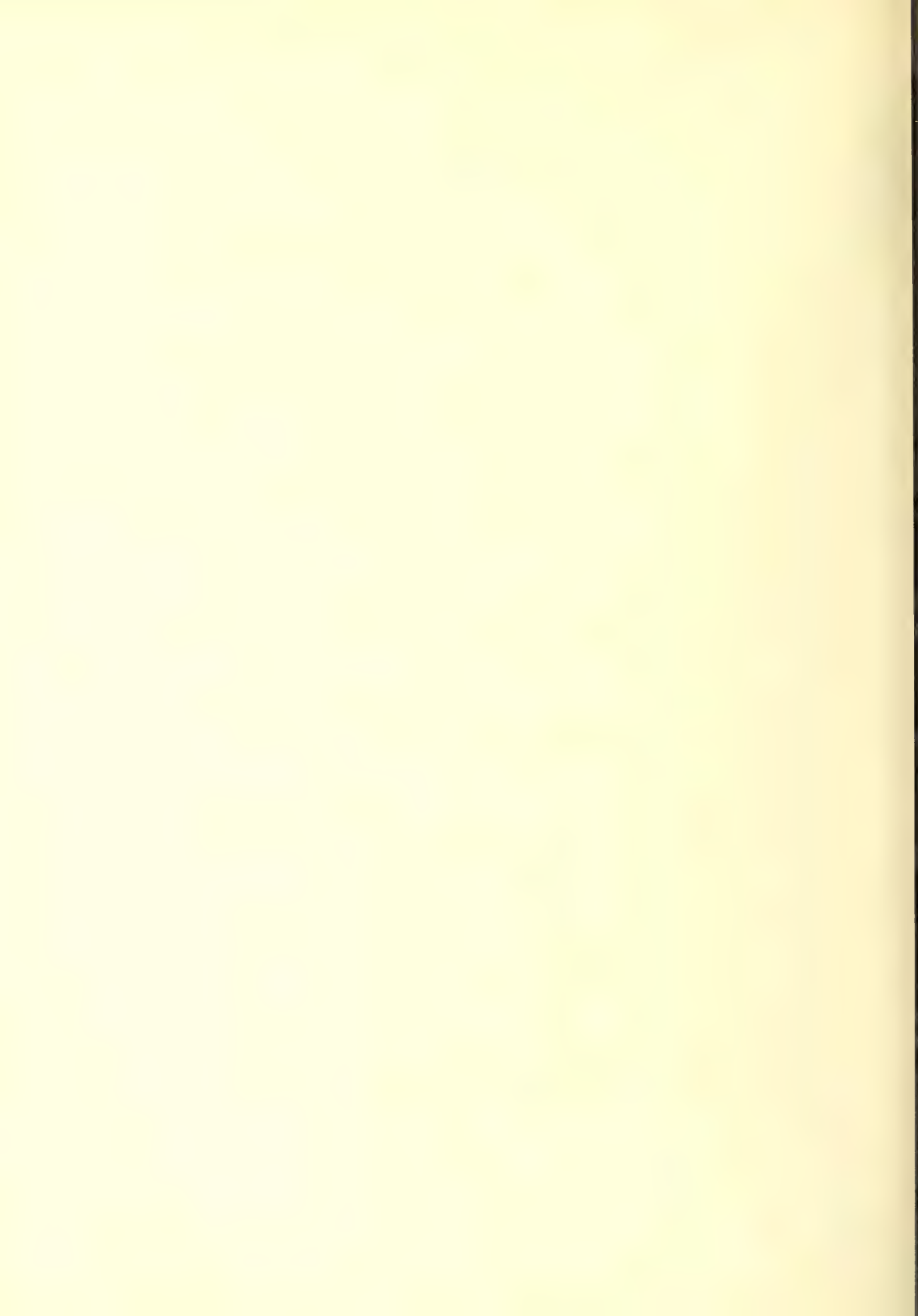


Figure 29
The average cost for street lighting to the city compared in annual cost per capita for Toronto, Buffalo and Montreal.

Legend

- City of Toronto
- City of Buffalo
- City of Montreal

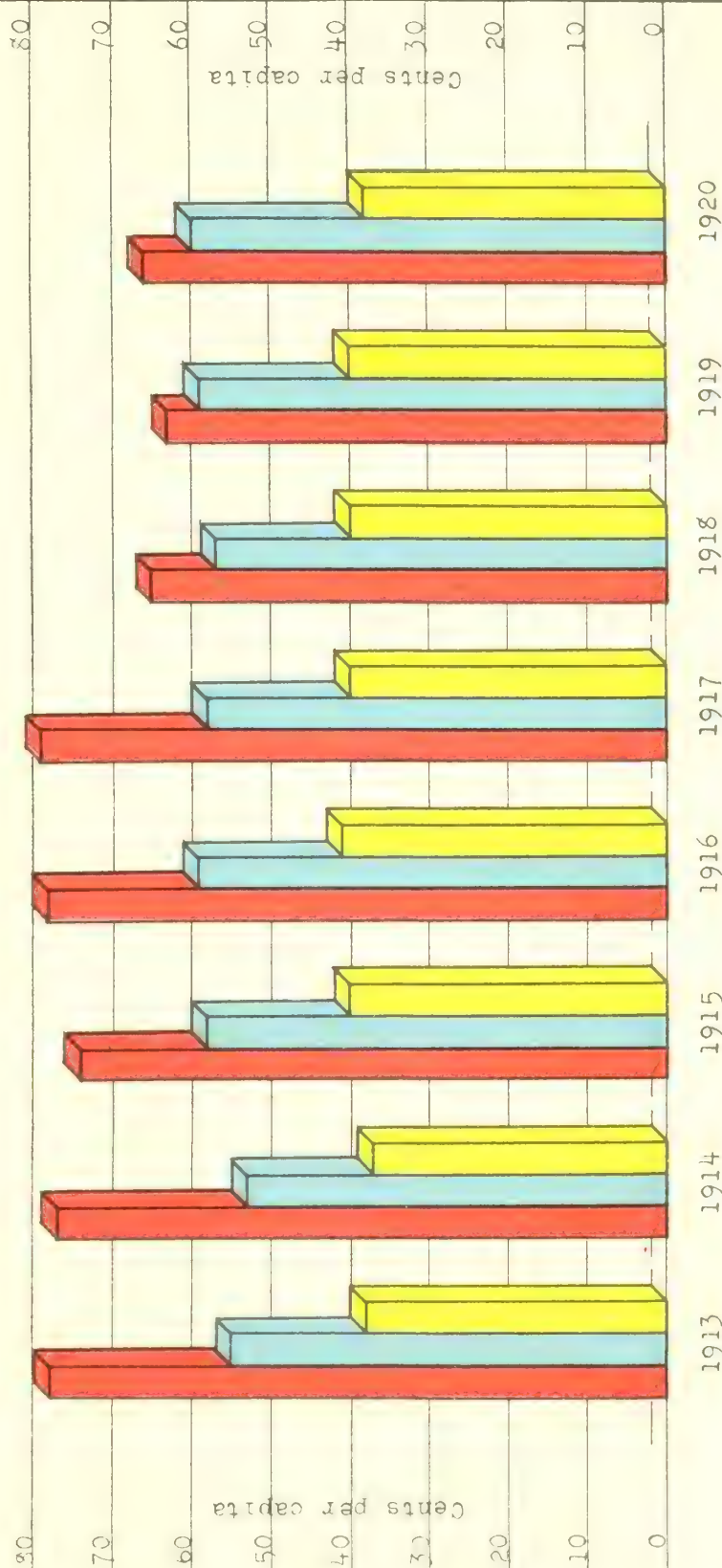




Figure. 30
Comparison of revenues from different classes
of business for Toronto Hydro and the city
of Buffalo.

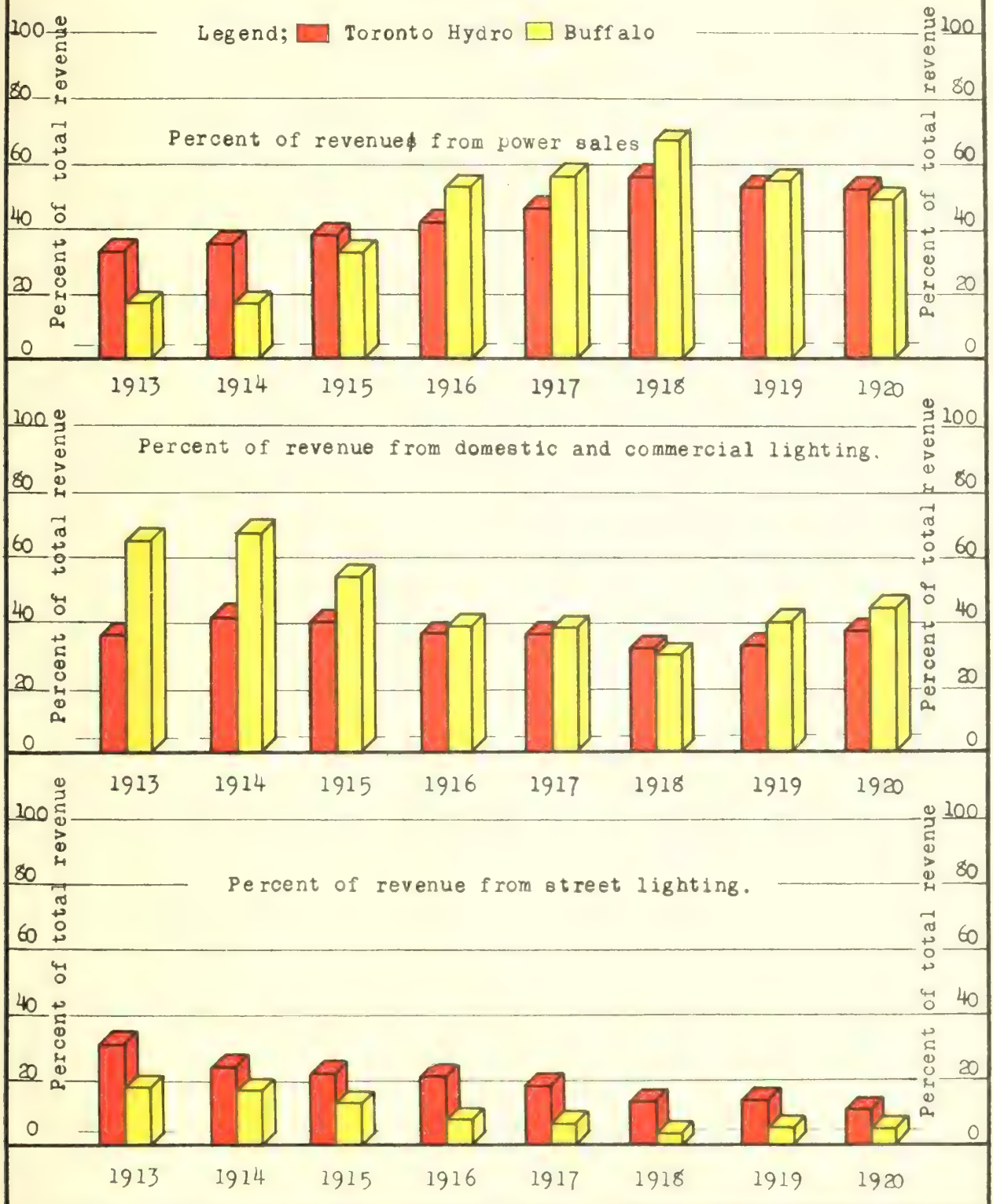




Figure 31

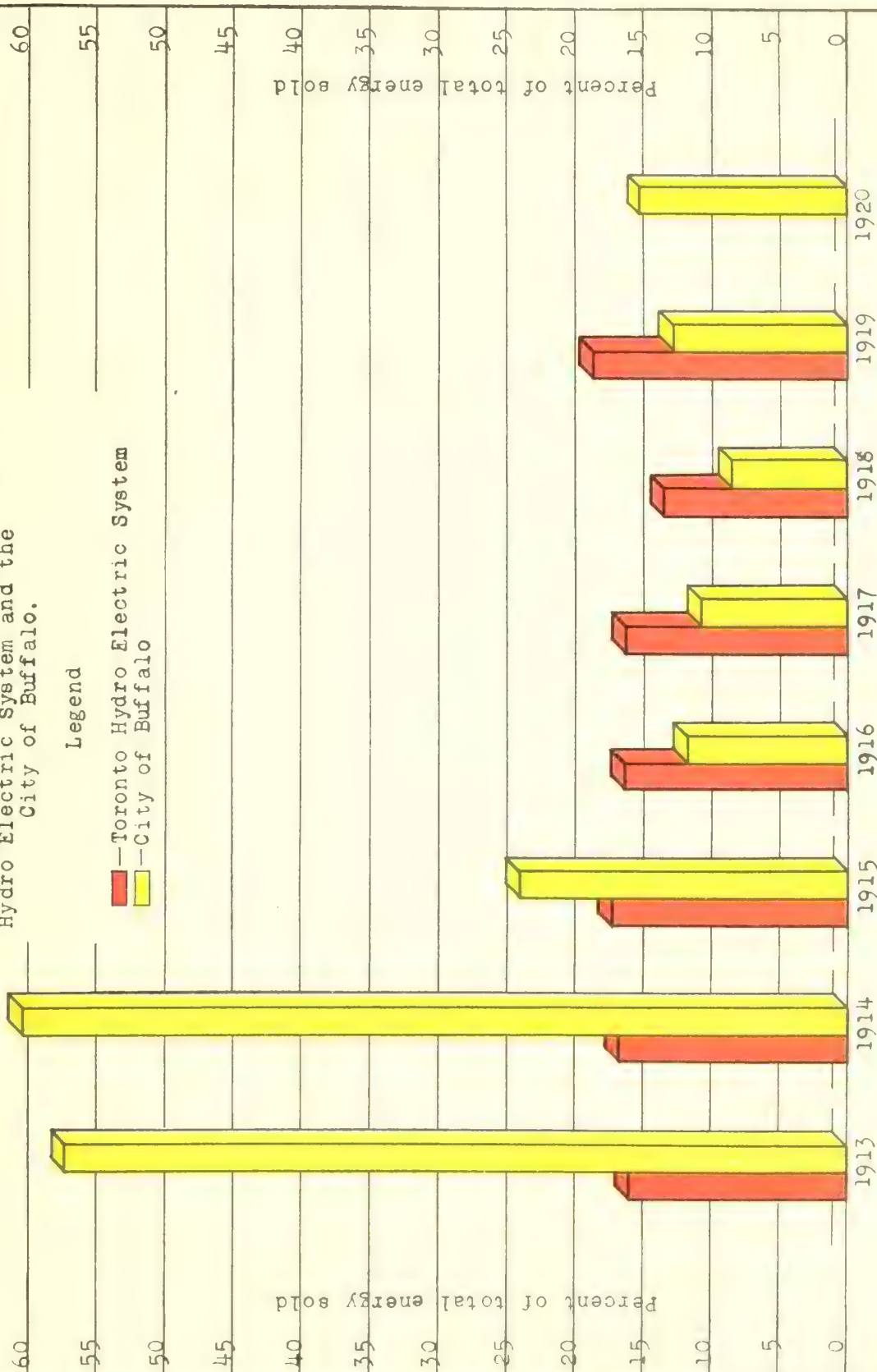
Comparison of energy sold for domestic and commercial lighting by the Toronto Hydro Electric System and the City of Buffalo.

Legend

—Toronto Hydro Electric System
—City of Buffalo

Percent of total energy sold

Percent of total energy sold



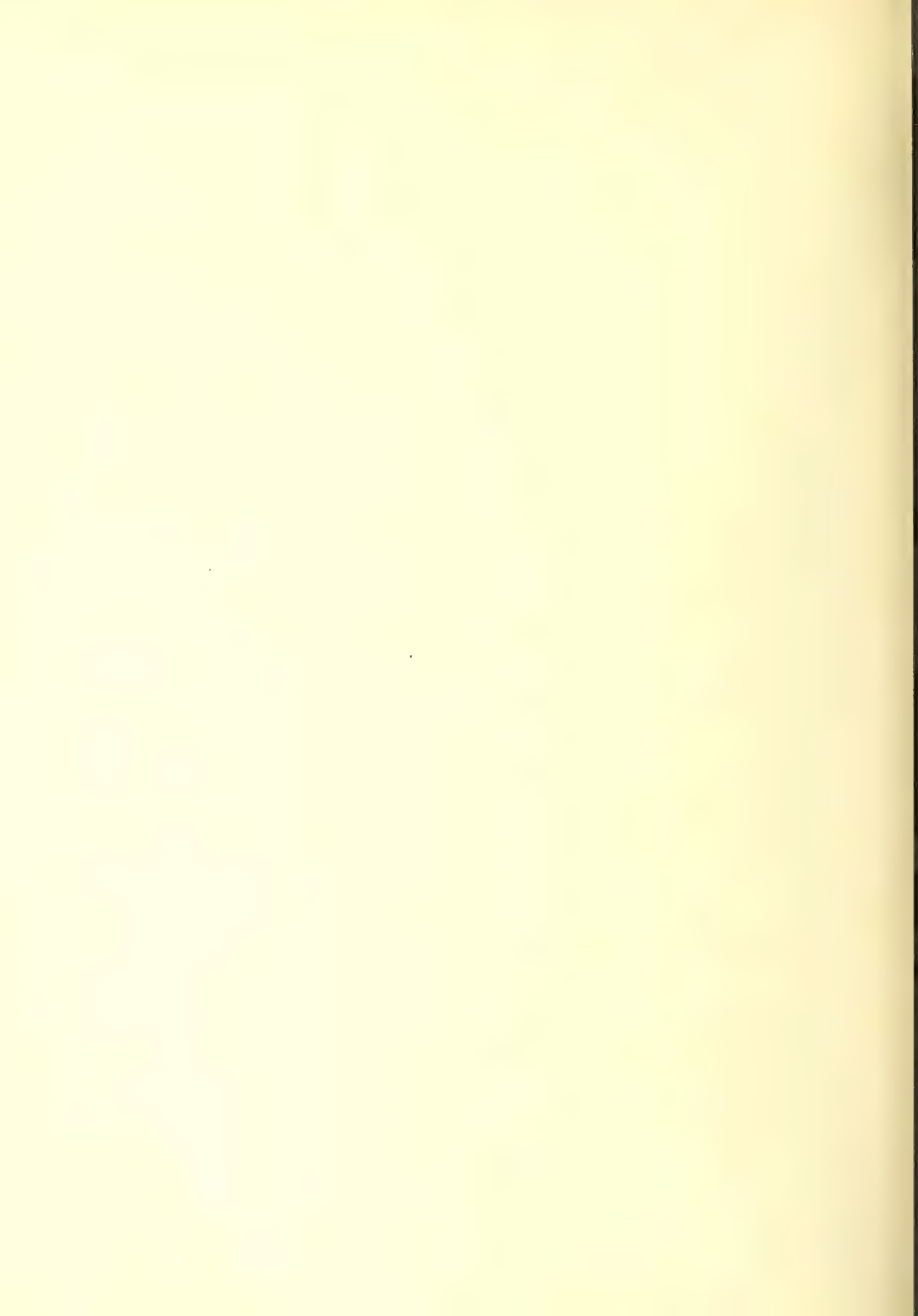


Figure 32
Relation of the city of Toronto to the Niagara System.

Legend

- The ratio of the population of Toronto to the total population of the Niagara District served by the H.E.P.C.
- The ratio of the horsepower taken in Toronto to the total horsepower taken in the Niagara District.

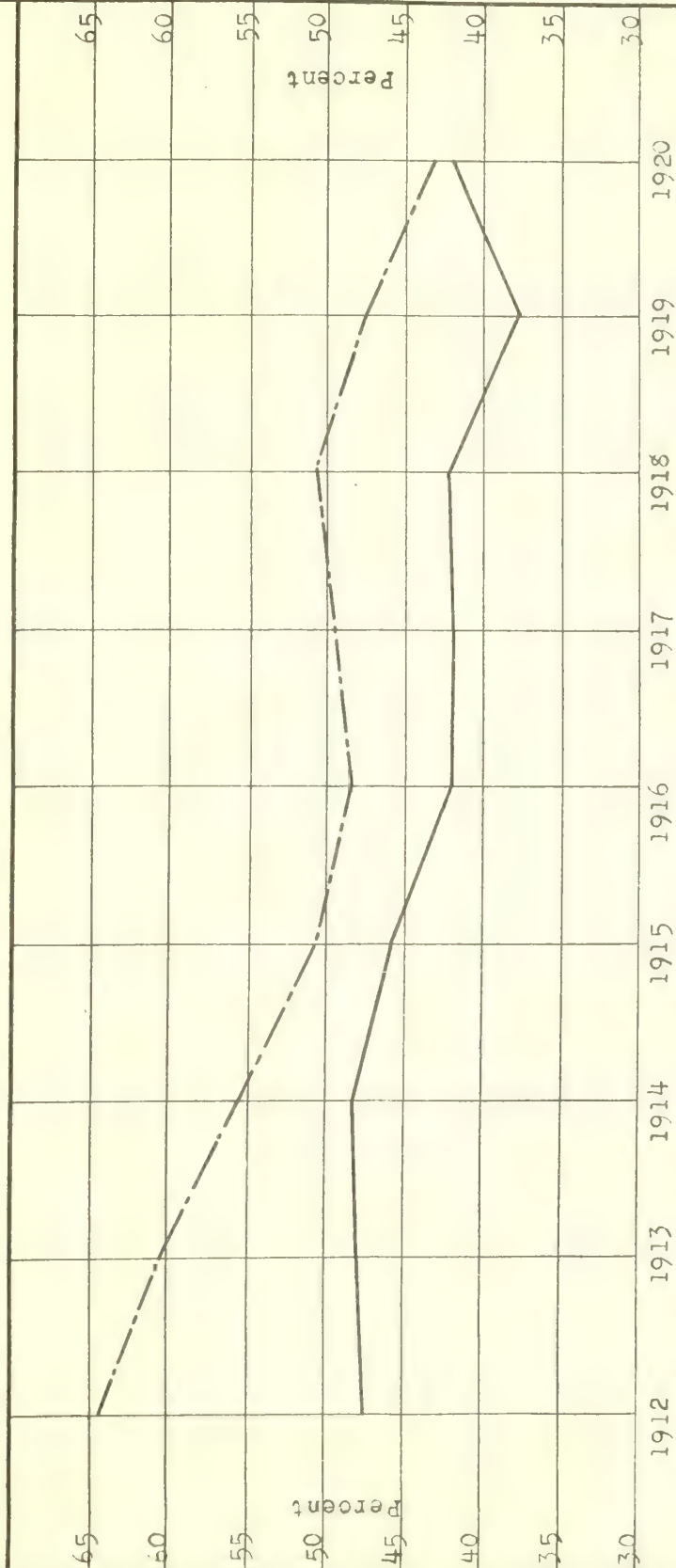
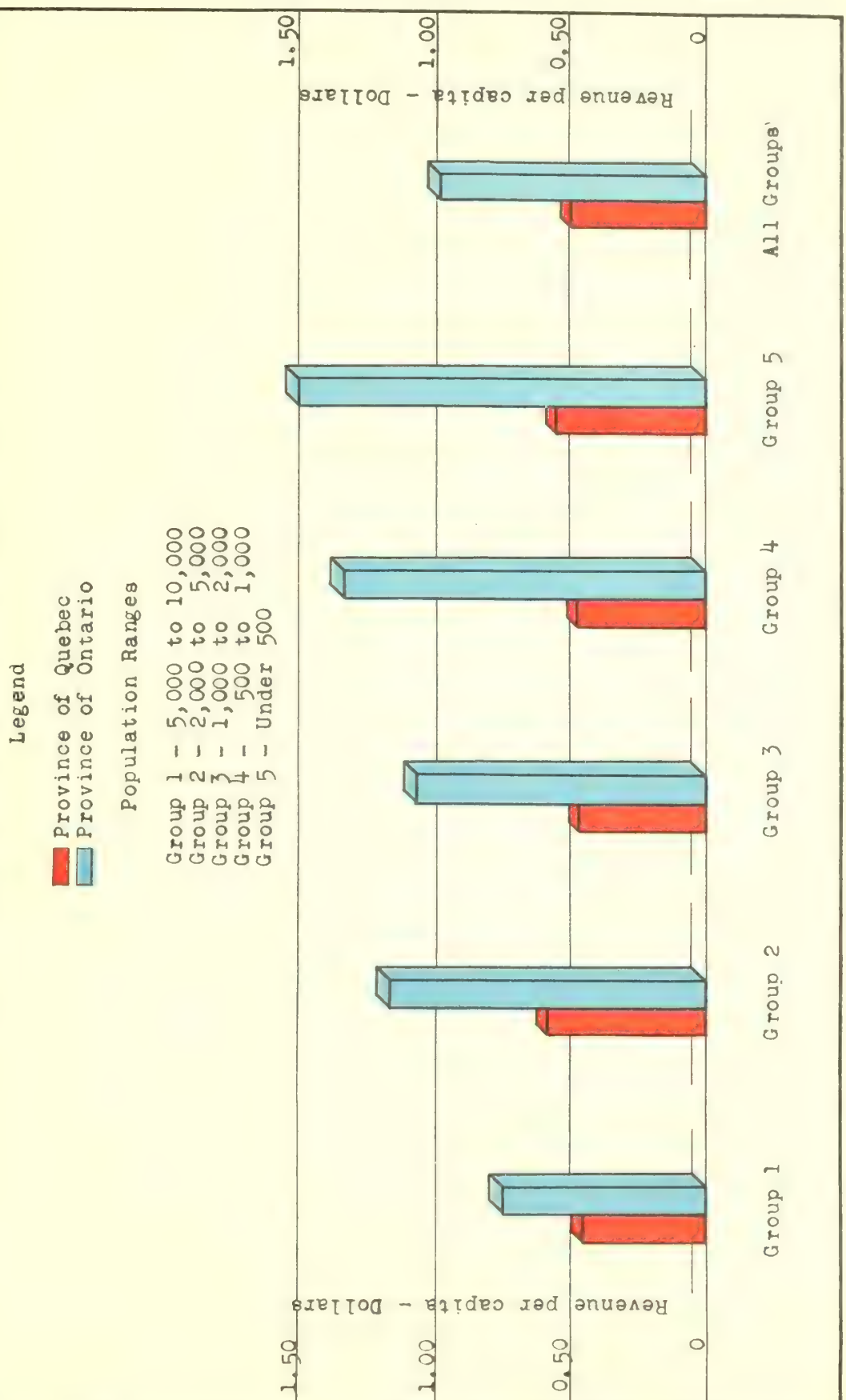


Figure 33
The annual load factor compared for the city of Buffalo, the Toronto Municipal system and for all the electric utilities in Toronto.





Figure 34
Street lighting revenue per capita compared by population groups for 44 municipalities in the Province of Quebec and 39 municipalities in the Province of Ontario.



In Figure 31 there is shown a proportion of the total energy sold for domestic and commercial lighting purposes. Over the average of the period between 1913 and 1919, the Toronto Hydro-Electric Power Commission has sold about 50% of its total energy for this class of service, and since 1914 the average for the Buffalo Company has not been far different from this amount.

Considering these facts with the comparative revenues for this class of service given in Figure 29 indicates that the cost of domestic and commercial lighting to the people of Toronto receiving service from the Hydro-Electric Power Commission is not so much lower than that to the people of Buffalo, receiving the same class of service. At this point it is also interesting to compare the total energy sold per capita in the cities of Toronto, Buffalo and Montreal. This amounts to 930 kilowatt hours per capita for Buffalo, 854 kilowatt hours for Toronto, inclusive of the Toronto Electric Company and the power used by the street railway company, and 1,060 kilowatt hours per capita for Montreal and its suburbs.

The importance of Toronto in the Niagara System is illustrated by Figure 32, which shows the ratio of the population of Toronto to the total population of the Niagara District, and the ratio of the horsepower in Toronto to the total horsepower purchased from the Niagara System. In 1912 Toronto comprised 65% of the population served, but by 1920 this proportion had dropped to about 44%. In 1919 Toronto purchased about 47% of all of the power sold on the Niagara System. This has been gradually falling off until for 1920 it represented about 42%. However, when the "Clean Up Deal" is consummated, the proportions in respect to the horsepower purchased will be materially changed, as nearly 100,000 horsepower in addition will be added to Toronto's purchases as a result of acquiring the Toronto Electric Company and the sale of power to the Toronto Street Railway Company.

One of the reasons for the cheaper cost of power to the people of Buffalo than to those for the city of Toronto is the higher degree of utilization of plant capacity in Buffalo. This is illustrated in Figure 33, which shows the annual load factor compared for Buffalo and for Toronto, and in the case of Toronto the load factor is shown both for the operations of the Toronto Hydro-Electric Power Commission and for the total of all electric utilities operating in Toronto.

For 1920 the load factor at Buffalo is about 54%, as compared to about 38% for Toronto, showing a higher degree of utilization of the plants, transmission lines, etc., by 50% for Buffalo. Such use of the investment does much to lower the cost of power to the people in that the fixed charges against the investment are spread over a larger number of kilowatt hours.

Comparisons of the Cost of Street Lighting for Small Municipalities in the Provinces of Ontario and Quebec

The cost for street lighting in Toronto, as com-

pared to that for Montreal and Buffalo, has been previously commented upon. The street lighting revenue per capita for 44 small municipalities in the Province of Quebec is compared to that for 39 municipalities of about equal size in the Province of Ontario in Figure 34. The municipalities in Ontario were selected so as to scatter them widely over the entire region served by the Hydro-Electric Power Commission, and as near as was possible to obtain an average representative cost for street lighting for municipalities within the population limits named.

Referring to Figure 34, it will be noted that the average revenue per capita for street lighting in the Province of Quebec is very uniform, averaging about 50 cents per capita per year, while that for the several groups in Ontario varies over wide limits, the minimum revenue per capita from this class of business being approximately 75 cents, while the maximum is about \$1.50.

It is also interesting to note that as the population of the groups in Ontario becomes relatively smaller, the cost for street lighting per capita, in general, increases with the exception of group 5, which is for municipalities of under 500 people.

The average revenue obtained from street lighting per capita in Ontario, from these small communities, amounts to about 99 cents, as compared to that of 49 cents for communities of like size in Quebec, which is a greater cost for Ontario by about 100%.

Figure 35 shows the population for the equivalent of 100 watts of street lighting in these small municipalities, and those served by the Hydro-Electric Power Commission in Ontario show a much greater quantity of light being furnished than to the municipalities considered for Quebec.

The average population of all of these communities per equivalent of 100 watts of street lighting is 24.4 per 1,000 of population in Quebec, and 12.7 of 1,000 of population in Ontario, indicating that the amount of illumination furnished by Hydro service to the municipalities in Ontario is about 92% greater than that furnished in Quebec. These averages, when considered with the revenues per capita, indicate that the revenue per equivalent 100 watts of illumination is slightly less for the municipalities of Quebec than for those in Ontario receiving Hydro service.

Proportion of Annual Revenue Represented by Capital Additions

In Figure 36 the proportion of revenues represented by capital additions have been compared for the American companies in the Niagara district, the Quebec companies in the St. Lawrence Valley and the systems operated or supervised by the Hydro-Electric Power Commission of Ontario. Capital additions and revenues have been analyzed between the years of 1913 and 1920 inclusive for the operations of the Hydro-Electric Power Commission, and for the American companies in the Niagara district, while for the Quebec companies in the St. Lawrence Valley the period covered was from 1916 to 1920 inclusive.

Figure 36 shows that the capital additions

expressed as a percentage of the revenue were 390% greater for the properties operated by the Hydro-Electric Power Commission than for the American companies in the Niagara district, and was 630% greater for the operation of the Hydro-Electric Power Commission than for the Quebec companies in the St. Lawrence Valley. Inasmuch as the analysis for the Quebec companies did not include the period from 1913 to 1915 inclusive, the figures given for that group may be somewhat lower than they would have been had they included the entire period covered for the American companies, and the Hydro-Electric Power Commission, owing to the fact that with the high prices prevailing during the period of the World's War, construction in Quebec was slowed down to a certain extent.

The proportion of revenue represented by capital additions for municipalities in Ontario served by the Hydro-Electric Power Commission is about the same as that for the total of all operations of the American companies, and is somewhat greater than that for the Quebec companies in the St. Lawrence Valley.

The complete government electric utility system in Ontario is represented by the sum of the operations of the Hydro-Electric Power Commission, and those of the municipalities and the capital additions of those in per cent of revenue are greater by 200% than those for the American companies in the Niagara district, and are greater by 350% than those for the Quebec companies operating in the St. Lawrence Valley.

There is also included in the figure, as a matter of interest only, the relation of revenue to capital additions including construction in progress by the Hydro-Electric Power Commission of Ontario, and these figures indicate that the capital additions expressed, as a proportion of the revenue will be nearly doubled when the present construction being undertaken is placed into service.

Cost Data Pertaining to Forty-one Municipalities Using Hydro Power in 1919

Power is sold by the Hydro-Electric Power Com-

mission of Ontario to the Municipal Commissions on a cost basis. The method used in determining this cost has been explained in Section "H." The effect of the use of such a rate is well illustrated in Table No. 24 following, in which certain characteristic data for forty-one municipalities has been tabulated. The first eighteen municipalities given in this table are served from the Niagara System, and these municipalities were selected in groups of two so as to geographically cover the entire system. In each group there has been selected a large municipality located close to a small municipality in order to determine what difference in cost resulted from the rate system employed between large and small municipalities.

The first two municipalities shown are those of Toronto and Bolton, located fairly close to each other, near the eastern end of the Niagara System. Toronto in 1919 paid an actual wholesale rate to the Hydro-Electric Commission of \$16.70 per horsepower year as compared with \$53.80 for Bolton. The ultimate retail cost to the consumer per horsepower year was approximately twice as much for Bolton as it was for Toronto.

The fiscal year for the municipality differs from that of the Hydro-Electric Commission by two months, so that it has been necessary in order to determine the ultimate retail cost to the consumer to estimate the horsepower taken by the municipality for the Commission's fiscal year. A check was made upon this method for the year 1920, and it was found to be substantially correct.

The table contains information as to the municipality's debt, and also the liability of each municipality to the Commission for investments made by the Commission on its behalf. The municipality's debt and taxes given do not include debentures issued or taxes collected for school purposes.

Again referring to Toronto and Bolton as a comparison of a large municipality and a small one, it is to be noted that while the municipal liability of Toronto was increased only 14.2% through its interest in the Hydro System, that that of Bolton was increased by 428%. As long as the Hydro-Electric

TABLE NO. 24

VARIOUS COST DATA PERTAINING TO 41 MUNICIPALITIES USING "HYDRO" POWER IN 1919.

Item	Toronto	Bolton	Hamilton	Haegerville
Land Air Line distance from Niagara—Miles.	85	87	42	54
Population	499,278	675	108,143	1,058
Average hp. taken from "Hydro"	48,481	84	13,179	163
Interim wholesale rates charged per hp. year dollars.	14.50	43.00	14.00	34.00
Actual wholesale rates charged per hp. year dollars.	16.70	53.80	16.00	33.40
Average ultimate retail cost to consumer, per hp. year.	43.70	76.50	30.50	44.50
Net Municipal debentures other than electrical—(\$1,000)	86,700	11.3	11,200.0	14.5
Net electrical municipal debentures—(\$1,000)	9,154.6	11.5	1,008.8	7.0
Municipal liability for Commission investment (\$1,000)	3,148.0	36.9	570.1	35.1
Increase in municipal liability by municipal ownership (%)	14.2	428	10.4	290
Revenue per kw.-hr. domestic lighting—cents.	2.5	7.5	2.3	4.3
Revenue per kw.-hr. commercial lighting—cents.	2.2	6.2	1.3	2.8
Revenue per capita from street lighting—dollars. . . . .	.65	1.24	.67	1.01
Assessed valuation per capita—dollars.	1,243	427	812	400
Taxes per capita—dollars.	39.00	12.90	27.10	14.40
Tax rate—mills per dollar.	31.3	30.0	33.2	35.8

Figure 35

Population per 100 watt street light compared by population groups for 44 municipalities in the Province of Quebec and 39 municipalities in the Province of Ontario.

Legend

■ Province of Quebec
■ Province of Ontario

Population Ranges

Group 1 - 5,000 to 10,000
Group 2 - 2,000 to 5,000
Group 3 - 1,000 to 2,000
Group 4 - 500 to 1,000
Group 5 - Under 500

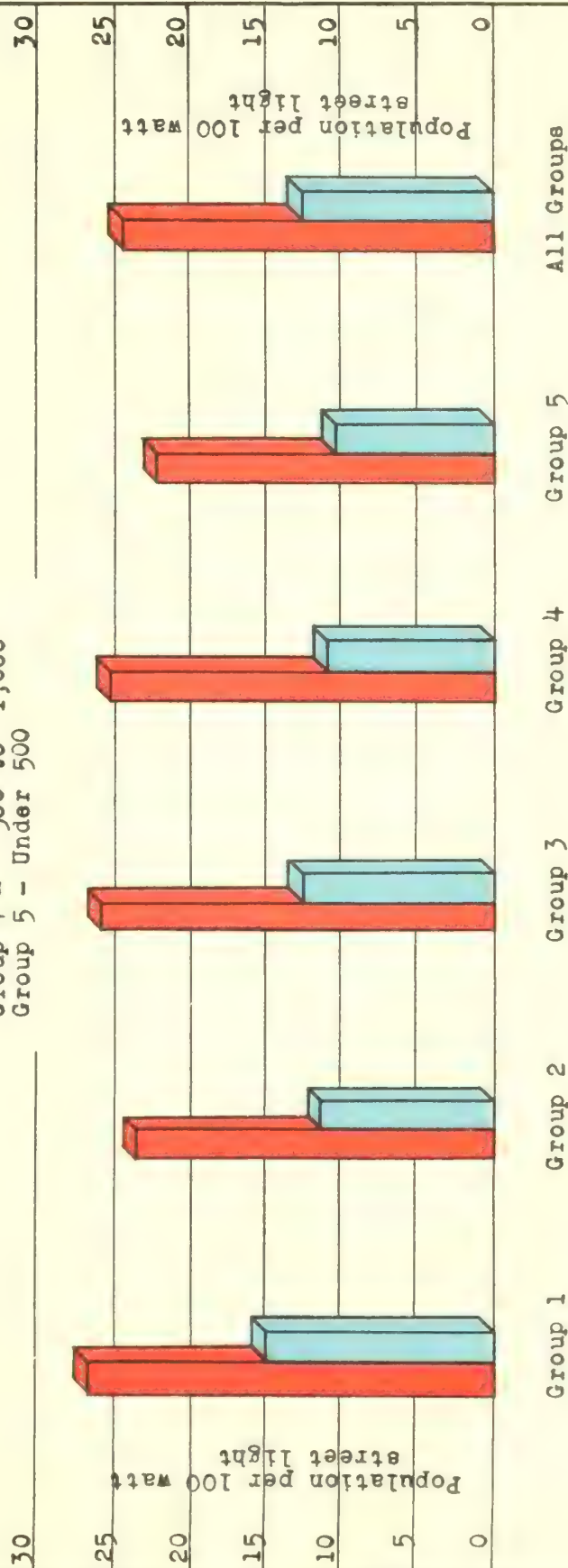
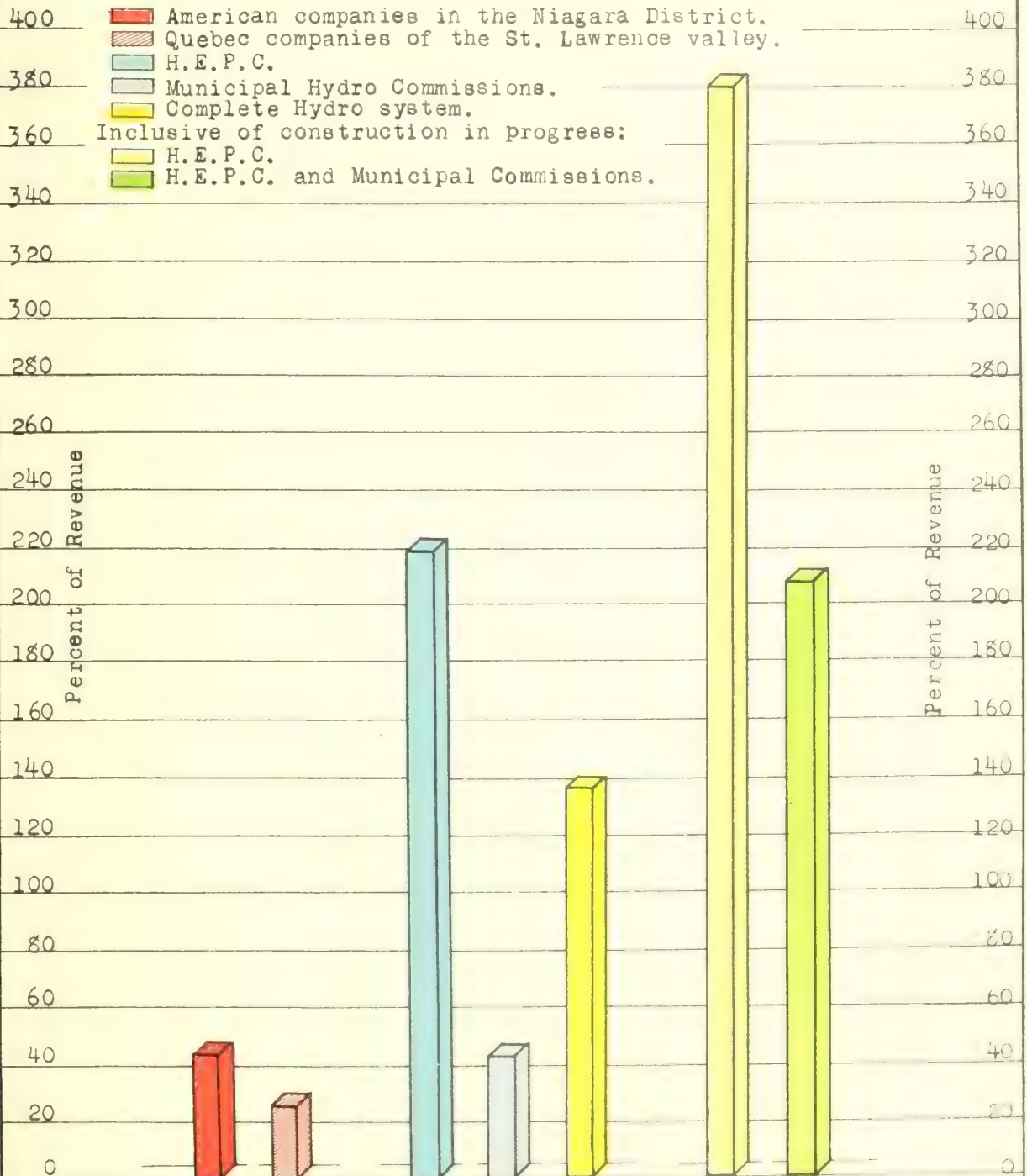




Figure 36
The proportion of revenues represented by
capital additions.

Legend

Operating capital only:





MURRAY AND FLOOD REPORT

TABLE NO. 24—Continued
VARIOUS COST DATA PERTAINING TO 41 MUNICIPALITIES USING "HYDRO" POWER IN 1919.

Item	Guelph	Georgetown	Hespeler	Kitchener
Land Air Line distance from Niagara—Miles.....	68	72	65	74
Population	17,032	2,032	3,000	21,056
Average hp. taken from "Hydro".....	2,829	397	308	4,866
Interim wholesale rates charged per hp. year dollars.....	19.00	36.00	21.00	19.00
Actual wholesale rates charged per hp. year dollars.....	18.70	33.50	23.20	19.65
Average ultimate retail cost to consumer, per hp. year.....	31.50	46.00	46.00	29.60
Net Municipal debentures other than electrical—(\$1,000)..	2,160.2	62.2	140.2	1,856.5
Net electrical municipal debentures—(\$1,000).....	116.1	18.2	18.9	211.8
Municipal liability for Commission investment (\$1,000)....	185.5	79.7	32.0	367.1
Increase in municipal liability by municipal ownership (%)	13.9	158	35.7	31.0
Revenue per kw.-hr. domestic lighting—cents.....	3.3	3.7	4.6	2.8
Revenue per kw.-hr. commercial lighting—cents.....	2.0	3.0	3.2	1.7
Revenue per capita from street lighting—dollars.....	.55	.80	.64	.67
Assessed valuation per capita—dollars.....	583	412	494	600
Taxes per capita—dollars.....	20.00	15.40	17.70	18.10
Tax rate—mills per dollar.....	34.5	37.6	35.8	30.0

Item	St. Thomas	Port Stanley	Sarnia	Forest
Land Air Line distance from Niagara—Miles.....	110	114	165	145
Population	17,759	732	12,646	1,422
Average hp. taken from "Hydro".....	2,168	121	1,933	102
Interim wholesale rates charged per hp. year dollars.....	24.00	53.00	38.00	63.00
Actual wholesale rates charged per hp. year dollars.....	24.80	47.00	32.30	58.20
Average ultimate retail cost to consumer, per hp. year.....	40.00	75.00	55.50	104.00
Net Municipal debentures other than electrical—(\$1,000)..	1,011.6	48.1	1,173.9	40.0
Net electrical municipal debentures—(\$1,000).....	101.6	15.9	233.7	28.2
Municipal liability for Commission investment (\$1,000)....	221.4	35.7	446.0	49.7
Increase in municipal liability by municipal ownership (%)	31.8	108	57.7	197
Revenue per kw.-hr. domestic lighting—cents.....	2.9	Flat	4.7	9.8
Revenue per kw.-hr. commercial lighting—cents.....	1.9	"	4.2	9.8
Revenue per capita from street lighting—dollars.....	.79	2.18	1.04	2.00
Assessed valuation per capita—dollars.....	645	609	774	444
Taxes per capita—dollars.....	19.70	20.60	27.00	16.00
Tax rate—mills per dollar.....	30.5	33.0	35.0	36.0

Item	Windsor	Walkerville	London	Embro
Land Air Line distance from Niagara—Miles.....	207	205	107	92
Population	31,629	6,279	59,100	48
Average hp. taken from "Hydro".....	2,124	2,129	9,612	35
Interim wholesale rates charged per hp. year dollars.....	36.00	36.00	19.00	60.00
Actual wholesale rates charged per hp. year dollars.....	32.90	33.00	20.40	60.00
Average ultimate retail cost to consumer, per hp. year.....	68.50	50.50	42.50	83.30
Net Municipal debentures other than electrical—(\$1,000)..	2,583.4	521.3	7,500.0	17.1
Net electrical municipal debentures—(\$1,000).....	329.1	120.0	713.5	7.5
Municipal liability for Commission investment (\$1,000)....	491.0	493.0	768.0	17.8
Increase in municipal liability by municipal ownership (%)	31.7	117	198	148
Revenue per kw.-hr. domestic lighting—cents.....	3.9	5.3	2.4	9.2
Revenue per kw.-hr. commercial lighting—cents.....	3.0	3.8	1.9	9.4
Revenue per capita from street lighting—dollars.....	1.21	.65	.55	1.62
Assessed valuation per capita—dollars.....	864	1,045	704	484
Taxes per capita—dollars.....	26.50	33.30	26.10	12.70
Tax rate—mills per dollar.....	30.8	31.9	37.1	28.4

Item	Stratford	St. Mary's	Owen Sound	Flesherton
Land Air Line distance from Niagara—Miles.....	95	103	145	117
Population	18,106	3,886	11,768	378
Average hp. taken from "Hydro".....	1,462	475	935	58
Interim wholesale rates charged per hp. year dollars.....	25.00	28.00	28.00	26.00
Actual wholesale rates charged per hp. year dollars.....	25.30	29.60	29.60	25.80
Average ultimate retail cost to consumer, per hp. year.....	55.00	49.00	70.00	36.80
Net Municipal debentures other than electrical—(\$1,000)..	2,000.0	161.7	1,216.7	57.9
Net electrical municipal debentures—(\$1,000).....	204.2	32.6	141.0	5.1
Municipal liability for Commission investment (\$1,000)....	172.8	92.3	259.6	15.6
Increase in municipal liability by municipal ownership (%)	18.8	77	33.0	35.8
Revenue per kw.-hr. domestic lighting—cents.....	2.6	3.4	3.0	...
Revenue per kw.-hr. commercial lighting—cents.....	2.7	2.6	2.7	...
Revenue per capita from street lighting—dollars.....	.86	1.14	.98	1.33
Assessed valuation per capita—dollars.....	545	547	600	360
Taxes per capita—dollars.....	21.90	17.95	21.30	23.50
Tax rate—mills per dollar.....	40.0	32.8	34.7	65.4

MURRAY AND FLOOD REPORT

TABLE NO. 24—Continued

VARIOUS COST DATA PERTAINING TO 41 MUNICIPALITIES USING "HYDRO" POWER IN 1919.

Item	Durham	Chesley	Orangeville	Collingwood
Land Air Line distance from Niagara—Miles.....	120	136	89	128
Population	1,500	1,703	2,173	7,264
Average hp. taken from "Hydro".....	74	160	134	1,444
Interim wholesale rates charged per hp. year dollars.....	30.00	40.00	35.00	28.00
Actual wholesale rates charged per hp. year dollars.....	33.40	40.60	33.50	36.20
Average ultimate retail cost to consumer, per hp. year.....	75.50	65.00	57.00	43.30
Net Municipal debentures other than electrical—(\$1,000) ..	57.9	135.1	88.7	428.8
Net electrical municipal debentures—(\$1,000).....	16.0	24.4	29.8	24.0
Municipal liability for Commission investment (\$1,000)....	18.7	68.5	70.5	330.3
Increase in municipal liability by municipal ownership (%)	60.0	68.7	113.0	82.5
Revenue per kw.-hr. domestic lighting—cents.....	7.0	6.4	6.0	2.7
Revenue per kw.-hr. commercial lighting—cents.....	6.4	5.8	3.8	2.2
Revenue per capita from street lighting—dollars.....	.89	.74	.85	.54
Assessed valuation per capita—dollars.....	367	420	490	495
Taxes per capita—dollars.....	12.40	15.00	18.40	20.70
Tax rate—mills per dollar.....	33.6	35.8	37.7	41.8

Item	Barrie	Victoria Harbor	Coldwater	Omemece
Land Air Line distance from Niagara—Miles.....	122	145	145	140
Population	6,775	1,496	584	465
Average H. P. taken from "Hydro".....	554	35	40	....
Interim wholesale rates charged per hp. year dollars.....	29.00	35.00	40.00	....
Actual wholesale rates charged per hp. year dollars.....	31.40	50.20	62.00	....
Average ultimate retail cost to consumer, per hp. year.....	47.70	75.00	86.00	....
Net Municipal debentures other than electrical—(\$1,000) ..	....	5.7	26.3	53.3
Net electrical municipal debentures—(\$1,000).....	34.5	5.7	6.3	11.5
Municipal liability for Commission investment (\$1,000)....	182.9	11.2	14.8	....
Increase in municipal liability by municipal ownership ( %)	....	296.0	80.0	....
Revenue per kw.-hr. domestic lighting—cents.....	4.2	6.0	5.2	7.0
Revenue per kw.-hr. commercial lighting—cents.....	2.5	7.5	4.5	7.5
Revenue per capita from street lighting—dollars.....	.69	.36	.90	1.67
Assessed valuation per capita—dollars.....	85	221	546	416
Taxes per capita—dollars.....	34.00	8.55	22.30	27.10
Tax rate—mills per dollar.....	40.0	38.8	41.0	65.0

Item	Peterborough	Kingston	Wellington	Carlton Place
Land Air Line distance from Niagara—Miles.....	147	225	171	270
Population	21,230	23,261	802	3,884
Average H. P. taken from "Hydro".....	....	....	....	247
Interim wholesale rates charged per H. P. dollars.....	....	....	....	33.00
Actual wholesale rates charged per H. P. dollars.....	....	....	....	20.30
Average ultimate retail cost to consumer, per H. P.....	....	....	....	31.80
Net municipal debentures other than electrical.....	2,216.8	1,624.2	1.2	292.3
Net electrical municipal debentures—(\$1,000).....	220.0	277.8	9.8	40.0
Municipal liability for Commission investment (\$1,000)....	....	....	....	60.6
Increase in municipal liability through municipal ownership ( %)	....	....	....	34.2
Revenue per kw.-hr. domestic lighting—cents.....	3.3	6.0	....	....
Revenue per kw.-hr. commercial lighting—cents.....	2.2	5.1	....	....
Revenue per capita from street lighting—dollars.....	.68	.95	.42	....
Assessed valuation per capita—dollars.....	742	592	547	366
Taxes per capita—dollars.....	22.60	18.90	12.50	15.20
Tax rate—mills.....	30.4	31.9	22.8	41.5

Item	Perth	Brockville	Prescott
Land Air Line distance from Niagara—Miles.....	257	271	280
Population	3,545	9,326	2,660
Average H. P. taken from "Hydro".....	145	631	191
Interim wholesale rates charged per H. P. dollars.....	32.00	45.19	44.93
Actual wholesale rates charged per H. P. dollars.....	57.25	48.00	37.10
Average ultimate retail cost to consumer, per H. P.....	143.00	116.30	73.00
Net Municipal debentures other than electrical—(\$1,000) ..	333.2	906.0	157.6
Net electrical municipal debentures—(\$1,000).....	56.0	140.4	19.6
Municipal liability for Commission investment (\$1,000)....	85.4	286.3	51.1
Increase in municipal liability through municipal ownership (%)	41.5	47.0	45.0
Revenue per kw.-hr. domestic lighting—cents.....	6.2	7.9	5.5
Revenue per kw.-hr. commercial lighting—cents.....	4.7	7.3	5.1
Revenue per capita from street lighting—dollars.....	.37	.96	.94
Assessed valuation per capita—dollars.....	524	525	570
Taxes per capita—dollars.....	22.50	20.60	16.20
Tax rate—mills.....	43.0	39.2	28.0

MURRAY AND FLOOD REPORT

TABLE NO. 24—Continued
VARIOUS COST DATA PERTAINING TO 41 MUNICIPALITIES USING "HYDRO" POWER IN 1919.

<i>Item</i>	<i>Winchester</i>	<i>Gravenhurst</i>	<i>Hunstville</i>
Land Air Line distance from Niagara—Miles.....	300	161	186
Population	1,069	1,502	2,113
Average H. P. taken from "Hydro".....	72	359	826
Interim wholesale rates charged per H. P. dollars.....	69.84	13.28	23.75
Actual wholesale rates charged per H. P. dollars.....	52.50	18.30	24.80
Average ultimate retail cost to consumer, per H. P.....	83.50	40.20	30.30
Net Municipal debentures other than electrical—(\$1,000)..	36.0	157.5	65.2
Net electrical municipal debentures—(\$1,000).....	9.9	87.6	18.6
Municipal liability for Commission investment (\$1,000)....	30.0	41.6	161.1
Increase in municipal liability through municipal ownership (%)	108.0	82.2	275.0
Revenue per kw.-hr. domestic lighting—cents.....	4.9	4.5	5.0
Revenue per kw.-hr. commercial lighting—cents.....	6.4	2.5	3.5
Revenue per capita from street lighting—dollars.....	1.43	.83	.88
Assessed valuation per capita—dollars.....	1,450	370	286
Taxes per capita—dollars.....	62.00	16.20	11.90
Tax rate—mills.....	42.4	43.4	41.5

<i>Item</i>	<i>Cannington</i>	<i>Beaverton</i>	<i>Ottawa</i>
Land Air Line distance from Niagara—Miles.....	130	135	303
Population	818	932	107,732
Average H. P. taken from "Hydro".....	68	85	.....
Interim wholesale rates charged per H. P. dollars.....	50.50	45.00	.....
Actual wholesale rates charged per H. P. dollars.....	53.00	46.30	.....
Average ultimate retail cost to consumer, per H. P.....	81.00	79.00	.....
Net Municipal debentures other than electrical—(\$1,000)..	22.6	38.3	15,417.7
Net electrical municipal debentures—(\$1,000).....	14.0	13.8	700.0
Municipal liability for Commission investment (\$1,000)....	30.8	31.5	.....
Increase in municipal liability through municipal ownership (%)	154.0	118.0	.....
Revenue per kw.-hr. domestic lighting—cents.....	5.0	7.1	2.0
Revenue per kw.-hr. commercial lighting—cents.....	5.9	3.6	1.6
Revenue per capita from street lighting—dollars.....	1.04	1.06	.55
Assessed valuation per capita—dollars.....	464	443	1,060
Taxes per capita—dollars.....	15.00	13.20	29.80
Tax rate—mills.....	32.5	29.6	28.0

System meets its interest and sinking fund requirements there is no danger from such a situation, but should the system fail to meet such obligations it is questionable as to whether a municipality such as Bolton would be in a position to hold investors in its Municipal debentures free from loss. Provided rates can be maintained low enough to keep attracting business to the Hydro System, these large increases in municipal liabilities are not of themselves dangerous, but the danger lies in the fact that should the cost of power increase to a point where business begins to fall off, which with the theory of "power at cost" means the pyramiding of cost, the smaller municipalities will be placed in an extremely precarious position. Toronto and Bolton represent the two extremes of the increase in municipal liability through the ownership by the municipalities of the Hydro System.

The rate per kilowatt hour from domestic lighting varies from as low as 2.3 cents for Hamilton to as high as 9.2 cents for Embro. It is quite interesting to note the large difference in rates for this class of service, the variation between the maximum rate and minimum for this group of municipalities being in the ratio of practically four to one.

For commercial lighting the revenue per kilowatt hour varies from 1.3 cents for Hamilton to as high as 9.4 cents for Embro, and the ratio between the maximum and minimum for this class of service is 7.2 to 1

The revenue obtained from municipal street lighting also varies widely for the different municipalities, being a maximum in Port Stanley of \$2.18 per capita, and a minimum for Victoria Harbor of \$0.36 per capita. This shows the ratio between maximum and minimum of approximately six to one.



Index for Conclusions and Summary Report

Part I

	Page No.
Introduction	3
Summary of Conclusions	1
Summary Report	6
Questions Laid Before Sir Adam Beck	7
Interviews with Premier Drury and Hon. Peter Smith	7
Origin of the Hydro Movement	7
The Growth of Hydro Service	8
Water Power Development in Ontario and Quebec	8
Power Plant Capacity Constructed by Hydro	9
The "Clean-Up Deal"	9
The Hydro-Electric Power Commission	9
Investments Controlled by Hydro	9
The Powers of the Hydro-Electric Power Commission	9
Contrast Between Hydro and Commission in U. S.	10
Advantages Taken of Power Commission Act	10
The Function of the Hydro-Electric Power Commission	10
The Province's Commitments to the Power Companies at Niagara Falls	10
The Faith of the People in the Hydro-Electric Power Commission	11
Taxes in Ontario and Quebec Compared	11
✓ Taxes in Ontario	11
Taxes Received from Electric Utilities	12
The Queenston-Chippawa Development	12
Engineering Reports on Queenston-Chippawa Development	12
Water Available for the Queenston-Chippawa Development	13
Estimated Construction Cost of Queenston-Chippawa Development	13
Estimated Cost of Power from Queenston-Chippawa Development	13
The Results from the Queenston-Chippawa Development	15
- The Nipigon Development	15
- The Cost of Power from the Nipigon Development	15
Power Available to the Thunder Bay District	15
Hydro-Electric Power Commission's Rate Structure	15
Power at Cost	16
Rate Methods Applied in Ontario and California	16
Result of Hydro Rate Methods	16
Comparison of Wholesale Interim and Actual Rates	16
One Price for Power	16
Rate Discrimination in Ontario	17
Theory of Government Ownership	17
Sections Selected for Comparison	17
Relief from Taxes	18
Power Costs in Quebec and Ontario	18
Power Costs from Government and Private Electric Utilities in Canada	18
Average Cost of Power to the Ultimate Consumer	18
The Niagara Power Districts in Canada and United States	19
California Compared to Ontario	19
Quebec Compared to Ontario	19
Lower Average Prices to Consumers of Private Companies	19
Power Costs in Toronto, Buffalo and Montreal	20
The Cost for Street Lighting in Toronto, Buffalo and Montreal	20
Industrial Consumers in Ontario Carry the Burden	21
The Relation of Capital Expenditures to Revenue	21
Un-uniform Power Costs in Ontario	21

Part II—Index for Sections

Section	Title	
A	Correspondence between Mr. W. S. Murray and the electric utility companies, the Hydro-Electric Power Commission of Ontario and Officials of the Province of Ontario	23
B	Origination and growth of the Hydro-Electric Power Commission of Ontario	41
C	Laws in respect to the authority of the Hydro-Electric Power Commission of Ontario, and the relation of the Province and Municipalities to the Commission	77
D	The cost of power to the people of Ontario served by the Hydro-Electric Power Commission	8
E	Indebtedness, assessments and taxes in the Provinces of Ontario and Quebec	110

Section	Title	Page No.
F	The Queenston-Chippawa Development for the Niagara System of the Hydro-Electric Power Commission of Ontario	127
G	The Nipigon Development for the Thunder Bay System of the Hydro-Electric Power Commission of Ontario	143
H	Rates for power to the people of Ontario using Hydro-Electric Power Service, and comparison of the rate-making method employed by the Hydro-Electric Power Commission with those of the California Railroad Commission	154
I	Comparison in respect to the cost for power to the people of the Provinces of Ontario and Quebec, and for certain sections of the United States	182

Index of Plates

Plate	Section	Title	Page No.
1	B	General map of the physical structure of the Hydro-Electric Power Commission of Ontario	65
2	H	Hypothetical Electric Utility System for demonstration of rate making methods employed by the Hydro-Electric Power Commission and the California Railroad Commission	157
3	H	Interim rates per horsepower for wholesale power charged to Municipalities by Ontario Hydro-Electric Power Commission	161
4	H	Wholesale cost of power in 1920 to the Municipalities in the Niagara Peninsula of Ontario	165
5	I	Districts served from Niagara Falls in the United States and Canada	187

Index to Figures

Figure No.	Section	Title	Page No.
1	B	Estimates with respect to the cost of power compared to the actual cost paid for the Niagara System, on a 30,000 horsepower basis	43
2	B	Estimates with respect to the cost of power compared with the actual cost paid for the Niagara System, on a 100,000 horsepower basis	45
3	B	The total population of Ontario with the population of the districts served by the Hydro Systems and the number of Hydro consumers	47
4	B	The service performed by Hydro for the people of Ontario	49
5	B	The growth of water power development per capita in the Provinces of Ontario and Quebec	51
6	B	Relation of generating capacity owned by the Hydro-Electric Power Commission to the peaks upon the systems served	57
7	B	Actual Load Curve of the Hydro-Electric Power Commission of Ontario exclusive of the Thunder Bay and Ottawa Systems for the years 1919 and 1920	61
8	D	Relation of the liabilities of the Hydro-Electric Power Commission to the liabilities of the Province of Ontario	83
9	D	The wholesale cost for power to Municipalities for the several systems, and to companies served directly by the Hydro-Electric Power Commission in 1920	91
10	D	Relation of "cost of power" and transmission cost to the total wholesale cost for power delivered by the Hydro-Electric Power Commission to Municipalities of the Niagara System from 1919 to 1920	95
11	E	Taxes and expenses compared for the Provinces of Quebec and Ontario in 1919 as derived from the report of the Dominion Bureau of Statistics—per capita basis	111
12	E	Taxes and expenses compared for the Provinces of Quebec and Ontario in 1919, as derived from the report of the Dominion Bureau of Statistics—mills per dollar of taxable property	113
13	E	Taxes, Bonded Debt and Sinking Fund per capita for all Municipalities of 25,000 or less inhabitants in the Province of Ontario	117
14	E	Taxes, Bonded Debt and Sinking Fund in Mills per Dollar of Assessed Valuation for all Municipalities of 25,000 or less inhabitants in the Province of Ontario	119
15	E	The taxes which would be paid by the Government Electric Utilities of Ontario were their operations charged with taxes at the rates paid by private companies in the United States and Canada. Based on the relation of taxes to revenue	123
16	E	The taxes which would be paid by the Government Electric Utilities of Ontario were their operations charged with taxes at the rates paid by private companies in the United States and Canada. Based on the cost of taxes per kilowatt hour	125
17	F	Estimates and costs for power chargeable to the Municipalities of the Niagara System at busses of generating plants at Niagara Falls	141

MURRAY AND FLOOD REPORT—INDEX

Figure No.	Section	Title	Page No.
18	G	The power plant capacities available to the people of the several systems served by the Hydro-Electric Power Commission . . .	151
19	H	Totals of the average horsepower taken in 1920 by the Municipalities for each zone segregated into systems . . .	167
20	H	The retail cost of power to consumers compared to the actual wholesale cost, and to the interim wholesale rates charged by the Hydro-Electric Power Commission to the Municipalities in 1920 . . .	171
21	H	Base retail power rates for several Municipalities on the Niagara System for 1920 . . .	175
22	H	Base retail power rates for several Municipalities on the Hydro-Electric Power Commission Systems other than the Niagara System for 1920 . . .	177
23	H	Base retail power rates for Niagara Falls, Ontario, compared to those of Hamilton, Ontario, in 1920 and 1921 . . .	179
24	I	Comparison between the Niagara Power Districts of Canada and the United States of revenue, relation of Hydro-Electric to total generating capacity and energy generated per capita . . .	191
25	I	Comparison between the Ontario Government Electric utilities exclusive of power exported to the United States and private electric utility companies in California . . .	193
26	I	Comparison between the Ontario Government Electric utilities exclusive of power exported to the United States, Ontario private electric utility companies and Quebec private electric utility companies of revenue, relation of Hydro-Electric to total generating capacity and energy generated per capita . . .	195
27	I	The total revenue less taxes per kilowatt hour sold for the City of Buffalo and Montreal compared to Hydro in the City of Toronto . . .	199
28	I	The revenue less taxes per kilowatt hour for the cities of Buffalo and Montreal compared to the city of Toronto, including both the municipally owned and privately owned electric utility properties . . .	201
29	I	The average cost for street lighting in the city compared in annual cost per capita for Toronto, Buffalo and Montreal . . .	203
30	I	Comparison of revenues from different classes of business for Toronto Hydro and the City of Buffalo . . .	205
31	I	Comparison of energy sold for domestic and commercial lighting by the Toronto Hydro-Electric System and the City of Buffalo . . .	207
32	I	Relation of the City of Toronto to the Niagara System as to population and ratio of horsepower taken . . .	209
33	I	The annual load factor compared for the City of Buffalo, the Toronto Municipal System and for all electric utilities in Toronto . . .	211
34	I	Street lighting revenue per capita compared by population groups for 44 Municipalities in the Province of Quebec and 39 Municipalities in the Province of Ontario . . .	213
35	I	Population per 100 watt street light compared by population groups for 44 Municipalities in the Province of Quebec and 39 Municipalities in the Province of Ontario . . .	217
36	I	The proportion of revenues expended on capital additions for American companies in the Niagara District, Quebec companies of the St. Lawrence Valley, Hydro-Electric Power Commission, Municipal Hydro Commissions and complete Hydro System . . .	219

Index to Tables

Table No.	Section	Title	Page No.
1	B	Capacity and characteristics of the operating power plants owned by the Hydro-Electric Power Commission in 1919 . . .	55
2	D	The total investments in physical assets of the Hydro-Electric Power Commission, and of the Province of Ontario and the Municipalities therein in electric utility systems for 1920 . . .	87
3	D	Investments by the Hydro-Electric Power Commission in physical assets on behalf of the Municipalities by systems as of October 31, 1920 . . .	88
4	D	Investments and physical assets by the Municipalities in distribution systems, on their own behalf as of December 31, 1920 . . .	89
5	D	Investments in facilities of governmental electric utilities for 1920 in dollars per horsepower purchased, and in cents per kilowatt-hour generated or purchased . . .	90
6	D	The wholesale cost for power from the Hydro-Electric Power Commission of Ontario to the several Municipalities by systems as of October 31, 1920 . . .	94
7	D	Comparison of production costs for the Ontario Power Company under private and governmental management . . .	98
8	D	The annual expenses for operating the Ontario Power Company and of purchasing additional power for the Niagara System in 1919 and 1920 . . .	100

MURRAY AND FLOOD REPORT—INDEX

Table No.	Section	Title	Page No.
9	D	Power generated and purchased and unit costs for generation by the Ontario Power Company, and for power purchased from the Canadian-Niagara-Power Company for 1919 and 1920 .	100
10	D	The revenue of the Ontario Power Company with that received by the Hydro-Electric Power Commission for "cost of power" from the Niagara System in 1919 and 1920 .	101
11	D	Power sales and unit prices for power sold by the Ontario Power Company and the Hydro-Electric Power Commission for the Niagara System in 1919 and 1920	101
12	D	The retail cost for power to the ultimate consumer served by the Municipal Commissions as of December 31, 1920 .	102
13	D	Direct charges by the Hydro-Electric Power Commission against the Province of Ontario for the fiscal year of 1920	107
14	D	The wholesale cost of power to the Municipalities purchased from the Hydro-Electric Power Commission for the fiscal year of 1920	109
15	D	The retail cost of power to the ultimate consumer purchasing power in Municipalities taking Hydro-Electric Power Service for the fiscal year 1920	110
16	E	Comparative statistics for Municipalities in the Provinces of Quebec and Ontario	115
17	E	Summarization of Municipal statistics for all cities of over 3,000 population in the Provinces of Ontario and Quebec for 1919 .	116
18	H	Determination for wholesale rates to Municipalities using method employed by the Hydro-Electric Power Commission for the hypothetical system given in Plate 2	159
19	H	Wholesale interim and actual rates to the Municipal Commissions for the several systems of the Hydro-Electric Power Commission of Ontario for the year 1920	169
20	I	Dominion statistics in respect to the cost of power in Quebec and Ontario .	183
21	I	Dominion statistics in respect to the cost of power in Canada from private and government-owned electric utilities .	184
22	I	Dominion statistics in respect to the cost of power in Quebec and Ontario from private and government-owned electric utilities . .	185
23	I	Dominion statistics in respect to the cost of power in Ontario and Quebec from generating and non-generating companies . .	185
24	I	Various cost data pertaining to 41 Municipalities using "Hydro" power in 1919 .	216

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